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**GUIDE TO MOBILE AIRCRAFT  
ARRESTING SYSTEM  
INSTALLATION**



**DEPARTMENT OF THE AIR FORCE**

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AIR FORCE HANDBOOK 10-222, VOLUME 8  
1 MARCH 2000



*Operations*

## **GUIDE TO MOBILE AIRCRAFT ARRESTING SYSTEM INSTALLATION**

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This handbook addresses the actions necessary to install a Mobile Aircraft Arresting System (MAAS), including installation of the MAAS with the Lightweight and Standard Fairlead beams. A MAAS may be installed to meet a wide range of uses, such as an airfield survivability arresting system (for use on a bomb damaged runway), as a bare base asset for overseas deployment, or for emergency or contingency use at an established base. Users of this booklet include power production personnel and personnel on the installation teams. In addition, information is provided which is relevant for heavy equipment and engineering personnel assigned to assist with the installation, and for advance team and control center personnel involved in the planning and beddown at an installation or bare base. Installation team members are assumed to have a basic knowledge of the system and its operations and maintenance requirements. At least one of the individuals installing the MAAS shall be a task-qualified journeyman Power Production Specialist, 3E052, who can certify installation. The guidance is based on T.O.s 35E8-2-10-1, 35E8-2-5-1, and 35E8-1-11-2; Qualification Training Package 3E0X1-30C; Silver Flag Exercise Site MAAS Course; AFI 32-1043; AFPAM 10-219 Volumes 3 and 4; [Engineering Technical Letter] ETL 98-10; A-Gram 96-25; ASC-EG-TR-1998-1002 [test] Evaluation Report; and

AFH 10-222 Volume 2. This handbook provides guidance; it augments and integrates the three applicable Technical Orders. The Technical Orders remain the final authority for detailed installation, operation, and maintenance.

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## INTRODUCTION

### Background and Use of the MAAS

The MAAS is a pair of mobile units, each unit consisting of a BAK-12 arresting barrier mounted on a mobile trailer. The BAK-12 arresting barrier brake unit is an energy absorbing type system. Prior to the development of the MAAS, a fixed BAK-12 based system was used for expeditionary type installations; these systems required more than 100 man-hours to install and stopped aircraft within 950 feet. The MAAS was originally developed and tested to accommodate the recovery of fighter aircraft that had to return to a battle damaged airfield. In its unidirectional configuration with a 90-or 153-foot cable, the MAAS can be installed in as little as two hours and stop fighter aircraft in a 990-foot or 1,200-foot runout zone. Some MAAS units are being upgraded with configuration set 52F1000-6 to a configuration preset for the 1,200-foot runout. Each trailer contains the basic components of a fixed BAK-12 based arresting system and all the tools and hardware necessary for installation and removal, except for installation on soils with a low bearing pressure. The system is air transportable.

The MAAS can be installed:

- For use with unidirectional and bi-directional fighter aircraft operations,

- For rapid recycle operations when rapid aircraft recovery is needed,

- On airfields with fighter and wide body aircraft operations when either the Lightweight or standard Fairlead beam is used to provide increased runway standoff distances for wing clearance, and

- On concrete, asphalt, and soil surfaces.

MAAS units may be preset for the original MAAS application to allow engagements up to 40,000,000 foot-pounds of energy (i.e., a 40,000-pound aircraft engaging at 150 knots). Other units may be in an upgraded configuration to allow engagements up to 98,000,000 foot-pounds of energy (i.e., a 50,000-pound aircraft engaging at 180 knots or even heavier weight fighter aircraft engaging within the limits of the 98,000,000 foot-pound criteria). With upgrade configuration sets, the systems can be adjusted in the field to allow use with heavier weight fighter aircraft. Either MAAS configuration can be used with the Lightweight or standard Fairlead beams. **For heavier weight fighter aircraft, the MAAS units must be modified with different control valve cam speed reducer sprockets.** The MAAS's mobility, rapid installation times, wide range of installation methods, and self contained installation and operation capabilities make it a versatile system for use by civil engineering units.



## PLANNING FACTORS

### Operational Needs [Flying Mission Operations]

There are certain aspects of flying operations at your location that may affect your MAAS installation and operation. Personnel at their home station may be required to install a MAAS due to an aircraft accident or other condition that has damaged the runway or the permanently installed aircraft arresting systems. In this case, you should be familiar with your installation's types of fighter aircraft, their mission landing/takeoff speeds and weights, and whether or not wide-bodied aircraft capability and additional wing clearances will be required.

However, if you are deployed to a bare base situation, you may be facing wartime bomb or missile damage and be working with or for other USAF flying units, Navy or Marine flying units, and flying units from other allied nations. If this is your situation, then you will be called upon to support other types of aircraft operations. Therefore, you may be facing aircraft operations with different:

- Basic mission launch, recovery, and abort weights,

- Landing and abort speeds,

- Required length of touchdown zones,

- Sortie generation and recovery rates, and

- Runway operating surface widths and arresting cable lengths.

### **Operational Factors to Be Considered for Siting and Installation**

Based on the above information, the Wing or Installation Operations Center should pass the information through the Survival Recovery Center and/or your Civil Engineering control center to you so you can make the correct decisions on installation, operation, and maintenance of the MAAS units. Some of the operational siting considerations that will affect your site preparation, installation, and operation are:

Whether or not a Lightweight Fairlead or standard Fairlead beam is required to support the operations of wide-bodied aircraft that need additional wing clearances,

MAAS tape and cable lengths,

Whether or not the installation is unidirectional or bi-directional, and

Whether or not rapid recycle operations are required.

**CAUTION – PLANNING FACTORS:** When an aircraft's landing gear impacts the cable, the cable rebounds and flexes. **Operational testing has shown that the length of the arresting cable in relation to the distance between runway edge sheaves is the critical factor in avoiding tailhook skip caused by adverse cable harmonics.** To avoid adverse cable harmonics, **the optimum length of the cable should be at least 90% of the distance between the edge sheaves**, whether the sheaves are for the MAAS, Lightweight Fairlead beam, or standard Fairlead beam. **The tape length between the cable end and the edge sheave must be at least 7.5 to 10 feet (for centering purposes) and should also try to meet the 90% criteria.** The length of the cable **should never be less than 80% of the distance between the edge sheaves.** Use **7.5-10 feet and the 90% criteria** as the planning factors when planning for, locating, and installing the MAAS and/or Fairlead beams. Whenever there is time to preposition cable, order a cable of the correct size to meet the optimum length criteria. In addition to the 90- and 153-foot lengths of cable that come with the MAAS, the following are

additional inventory cable lengths for the BAK-12, 1.25-inch diameter cable that are compatible with the MAAS. P/N 515053-XXX: 105, 115, 130, 165, 175, 180, 185, 190, 195, 205, 230, 240, 280, 290, 295, 303, 390, and 490 feet.

### **Installation Planning**

When you are given the basic location on the runway where to install the MAAS, you will then know what kind of a surface installation method you need to use. The basic types of surface installations are:

Concrete and concrete with thin (less than 1" thick) asphalt overlay

Concrete with asphalt overlay (greater than 1" thick)

Asphalt over prepared base/soil

Soil

Permanently frozen (Permafrost) soil

Low bearing pressure soil

The situation where a very low bearing pressure soil exists within 25 feet of a runway (where you would install a MAAS or a Fairlead beam) should be limited, as most airfield runway shoulders require a higher bearing pressure for aircraft safety and foreign object damage control. These areas usually do not contain undisturbed native soils. A low bearing pressure soil is a soil that when tested (by engineering personnel or a laboratory technician) has a low bearing pressure (as determined by using a California Bearing Ratio (CBR) test), which provides a reading with a CBR of less than 7. Low bearing pressure soils are usually either a native soil, which is fine-grained with mostly organic clay or a combination of clay and silt, or soils which have been disturbed by bomb craters or previous barrier installation staking operations. Both of these conditions can create poor quality soils of low bearing pressure. Areas 100 to 200 feet away from the runway have a greater

chance of being a native soil, which may affect the installation of a MAAS if a Fairlead beam is installed.

While a MAAS can be installed on a low bearing pressure soil using deadman anchors, the Lightweight Fairlead beam requires at least a 15 CBR on undisturbed or recompacted soil. Performing a full CBR test may not be possible during a deployment, but an engineering technician trained in the use of a Dynamic Cone Penetrometer could make a quick determination, which provides comparable readings. A pre-site survey as a part of base planning should identify low bearing pressure soils with a CBR of less than 7.

#### **Differing Site Conditions**

Airfields are not constructed uniformly as a flat surface, so elevations, slopes, and soil conditions can vary along the length of the runway surfaces and taxiways. Avoid placing the MAAS where there will be interference with the tape runout. If it appears that site selection decisions were made that did not account for problems with site conditions when formulating the installation times and personnel provided to you, inform your Civil Engineering control center personnel of the situation immediately. Decisions on siting should have considered:

Additional time and resources to prepare the site when installing the MAAS with the Lightweight or standard Fairlead beam off the runway surface. This is especially true if personnel and equipment must perform heavy equipment operations to remove soil crowns, projections, deep ruts, and/or craters or crater upheavals, which would interfere with the tape runout and sweep area.

Transverse slopes exceed the operating limits of the MAAS and/or the Lightweight or standard Fairlead beams and heavy equipment operations are required.





## RESOURCES

Three groups of personnel may be needed to install a MAAS:

Barrier operation and installation personnel,

Heavy equipment personnel, and

Engineering personnel.

Various factors will dictate how many people are actually involved in the installation. The Technical Order states the ideal situation where 12 personnel are available: a four-person barrier crew (to set up the barriers, direct installation, and operate the MAAS during installation) and two four-person heavy equipment/pavements installation crews (each installing a MAAS unit at the same time). Installation time for a 12-person team is approximately 40 minutes. **Do not plan on having this many personnel while deployed.** Regardless of the team size available, the installation process will still consist of the following basic procedures:

Identify the general location on or along the runway where the MAAS is required.

Determine if any major site work is required.

Determine if a Lightweight Fairlead beam or a standard Fairlead beam will be required for installation with the MAAS (to provide for additional clearance for wide-bodied aircraft).

Tow the MAAS units and Lightweight Fairlead beam or standard Fairlead beam units (if required) and kits to the site.

Identify specifically where the units should be set up and determine centerline, runway width, and direction(s) of aircraft travel.

Identify if any site work for leveling the area is required for the specific location.

Position the units at the correct, specific location on each side of the runway.

Anchor the units.

Place and tension the cable and tape.

Proof load system (except during an emergency installation). Not discussed herein -- see the Technical Orders for this operational process.

### **Basic Team**

An installation team should consist of six well-trained personnel. A six-person team can install a MAAS in less than two hours at a bare base. Installation times can take longer when: site preparation is required, poor soil conditions require the use of deadman anchors, there are extreme weather conditions, and/or chemical/ biological conditions dictate wear of higher levels of MOPP. For faster installation times, especially on soil or asphalt over soil base, using additional personnel to provide two 4-person teams may allow installation of two MAAS trailers to run simultaneously, such as for emergency installations. Some installations can be accomplished with a 4-person team.

The barrier operator, who must be a task qualified journeyman electrical power production specialist (3E052), sets up and operates the MAAS BAK-12 unit and directs the efforts of the other members of the installation team. This lead person directs the initial placement and alignment of the MAAS units. On a six-person team, barrier operation personnel will be called upon to assist in most aspects of the installation. These personnel may be required to remove or direct the removal of airfield lighting system components that may obstruct the runout and sweep of the barrier tape.

Installation team members, who could include some heavy equipment/pavements personnel (3E2X1), are responsible for the installation of each MAAS unit. The members, using the MAAS's hydraulic power units, work in small teams of two or three persons each to anchor each trailer and/or Lightweight Fairlead beam. These personnel may be required to help remove debris in parts of the tape sweep area of the barrier.

Heavy equipment/pavements personnel may be required whenever: site preparation is required, low CBR soils are present, or the Lightweight or standard Fairlead beam are used. Specific examples of when additional resources will be required:

- Clear debris,

- Grade and re-level the runway shoulders,

- Adjust the ground slope near the MAAS units to allow them to have the proper incline for tape alignment,

- Install deadman anchors, or

- Build up a shoulder that is too low for installing the MAAS and/or a Fairlead beam.

Engineering personnel (3E5X1) may not be required to align every installation when the team personnel are experienced with normal set-up procedures. However, engineering personnel should be used:

- When establishing an airfield survivability barrier where the barrier is used as a part of a minimum operating strip (MOS).

- When a Fairlead beam system is required and the barrier operators require site surveyor support to more precisely align the system.

### Equipment

The MAAS trailers are configured as identical units that can be airlifted into an installation and then towed (figure 1) directly to the site.

**Figure 1. MAAS Trailers in Tow.**



As initially fielded the MAAS trailers were configured for installation in a unidirectional configuration. All trailers are being reconfigured to allow bi-directional installation for soil and asphalt over soil installations with heavy weight fighter aircraft. **Prior to installation, determine if there are any variations in the MAAS type configuration present at your location.** A trailer unit with a 19-stake kit is for unidirectional soil and asphalt-over-soil installations. A trailer unit with a 25- or 31-stake kit is for bi-directional operations on soil and asphalt-over-soil installations. MAAS trailers are self-contained in that they carry the equipment and tools necessary to install the MAAS. The equipment and tools are used for installation of the Lightweight and standard Fairlead beams.

**EXCEPTIONS:**

For installation on poor quality soils, such as soils that have low bearing pressures and require the use of deadman anchors, then deadman chain kits, heavy equipment, materials, supplies, and personnel may be needed.

For MAAS installation as a bi-directional system on concrete (if an upgrade kit has not already been added), then an additional concrete anchor kit will be required.

For installation with the Lightweight or standard Fairlead beams, a Lightweight Fairlead beam kit or Standard Fairlead beam kit and additional anchoring hardware and supplies will be required. Heavy equipment will also be required for placing and installing a Fairlead beam.

For the Lightweight Fairlead beam bi-directional use on concrete, four concrete anchor plate assemblies and two extra anchor bolts are required for each beam.

The MAAS trailer with BAK-12 (figures 2 and 3) contains the following installation equipment:

Soil and asphalt/soil installation tools, supplies, and components,

Cruciform stakes,

Moil points,

Concrete and concrete/asphalt tools and components,

Two hydraulic power units (HPUs) with 50-foot quick disconnect hydraulic hoses (see General Note),

Two hydraulic breakers (see General Note),

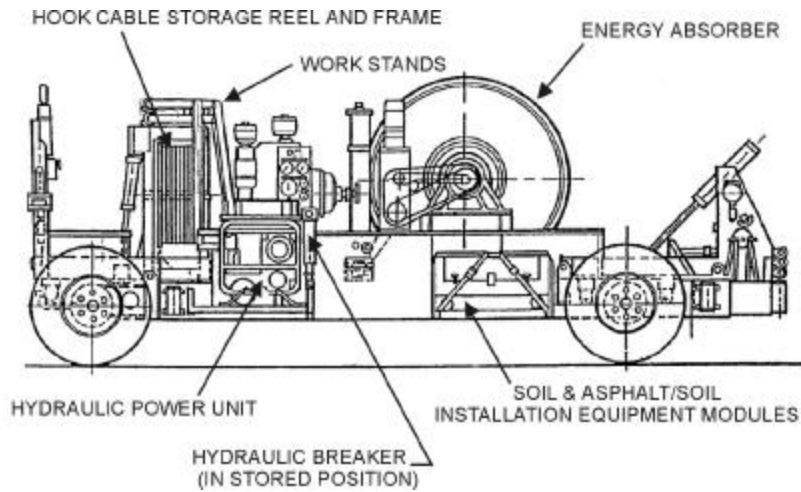
Two hydraulic hammer drills (see General Note),

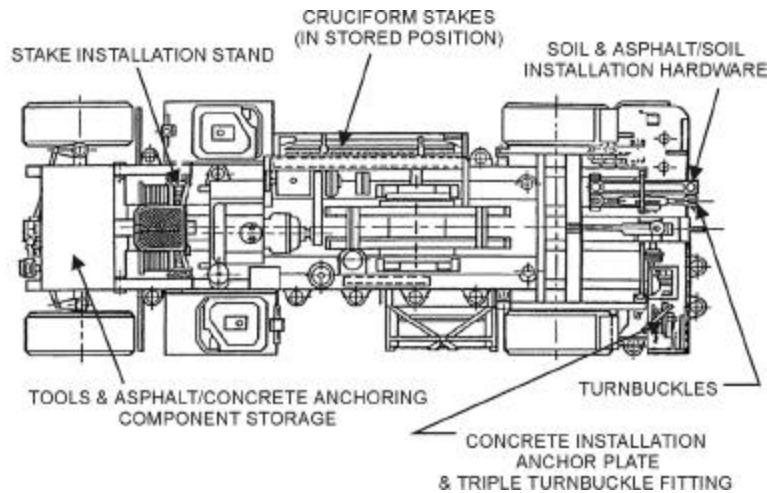
Cable storage reel (one MAAS has a 153-foot cable and the other MAAS has a 90-foot cable),

Stake installation stands (see General Note), and

Stake puller kit (see General Note).

**Figure 2. MAAS Equipment – Elevation View.**



**Figure 3. MAAS Equipment – Plan View.**

**GENERAL NOTE:** Upgrades to inventory equipment are replacing numerous installation tools and equipment, including the Wacker HPUs, hydraulic breakers, a stake puller, and hammer drills. The replacement equipment is with new Stanley: HPUs, hydraulic breakers, stake pullers, and hammer drills, as identified in the ETL 98-10 update. [See Attachment 1 for figures of the new equipment.] In the ETL 98-10 upgrade configuration, the MAAS trailers will have a separate Stanley stake driver (1 each), Stanley pavement breaker (1 each), a (current inventory) hydraulic ram stake puller withmoil point puller tool (1 each), a Stanley stake puller (1 each), and Stanley hammer drills (2 each). Check the inventory of equipment on the MAAS to determine if it is equipped with the Stanley upgrade. If it does have the upgrade, this will eliminate the need to switch between separate 8-foot and 50-foot hoses to raise and lower the trailers and work the breakers and hammer drills. If the new Stanley HPU and tools are not installed and the Wacker system is present, then when raising and lowering the trailer, use the

separate 8-foot hoses on the ancillary connections of the HPU diverter valve assembly and follow the MAAS technical order procedures.





## INSTALLATION

**This chapter is laid out to allow the user to identify from the major headings, only those areas of installation that are needed for their particular situation. The user then needs to refer to only those applicable sections.**

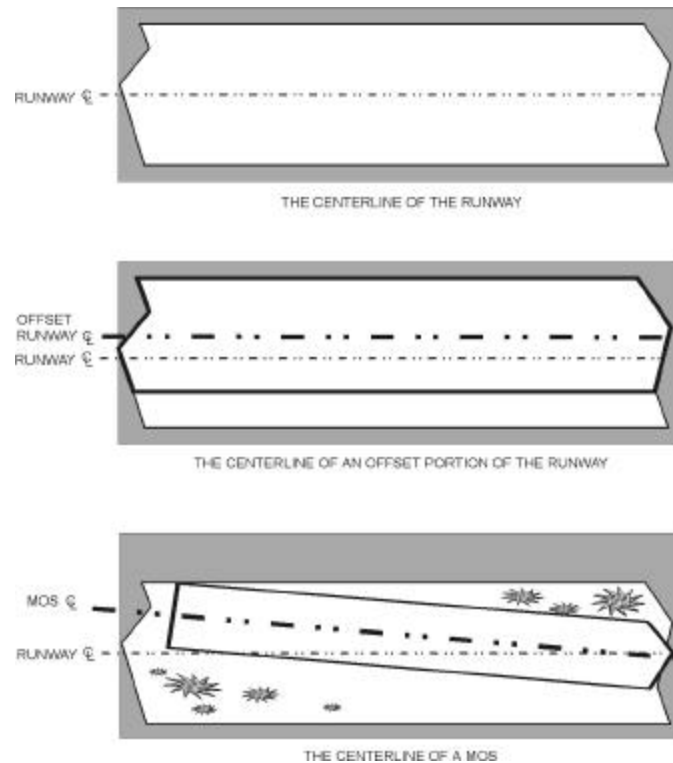
### **BASIC CONFIGURATON AND LAYOUTS**

The basic configuration and location for the MAAS is based on operational needs and siting requirements and is provided to you by the Wing or Installation Operations Center. To install the MAAS, you need to know the following installation requirements for the setup and installation of the MAAS and other barrier support systems.

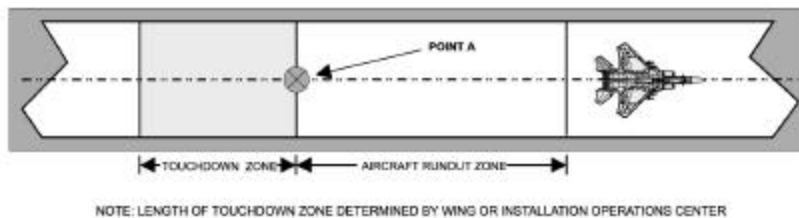
#### **Identify where the Aircraft Will Catch the Cable and the Direction of the Aircraft Operations**

**NOTE:** The centerline of the runway operating surface could be the centerline of the runway, the centerline of an offset portion of the runway, or the centerline of a MOS (figure 4). Ensure that all installation personnel understand which centerline you will be using as the centerline of the runway operating surface when establishing the locations for the MAAS and Fairlead beam (if required).

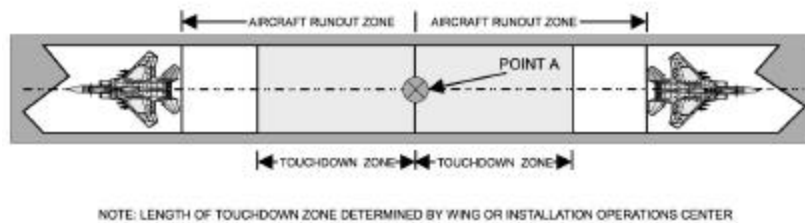
**Figure 4. Centerline of Runway Operating Surfaces.**



**Unidirectional:** If the installation is for unidirectional use, then locate both the centerline of the runway operating surface and the end of the touchdown zone. The intersecting point of the centerline with the end of the touchdown zone becomes **Point A** (figure 5) and the center point of the cable.

**Figure 5. Establishing Centerline Point A – Unidirectional Operations.**

**Bi-directional:** If the installation is for bi-directional use, then the center point of the cable is located with adequate aircraft runout zones in both directions. The centerline of the runway operating surface and start of the two aircraft runout zones with or without an aircraft clear area, becomes **Point A** (figure 6).

**Figure 6. Establishing Centerline Point A – Bi-directional Operations.**

**NOTE:** There should be at least 550 feet of smooth runway surface prior to the hook cable and 50 feet of smooth runway surface past the hook cable.

#### **Locate the End of the Aircraft Runout Zone**

To establish the end of the aircraft runout zone, select a point either 990 feet or 1,200 feet down the runway operating surface centerline. MAAS units reconfigured for a 1,200-foot runout provide less stress to the aircraft tailhook

assembly and/or the front landing gear assembly. Check the lengths of the cable and tape to ensure that supporting the selected runout distance is possible. At some bases or bare bases, barrier cable may be prepositioned for use with fixed barriers or expeditionary barriers using the BAK-12 barriers with Fairlead beams. This cable could be used with the MAAS, although the cable length may exceed the standard 90-foot and 153-foot cables available with the MAAS.

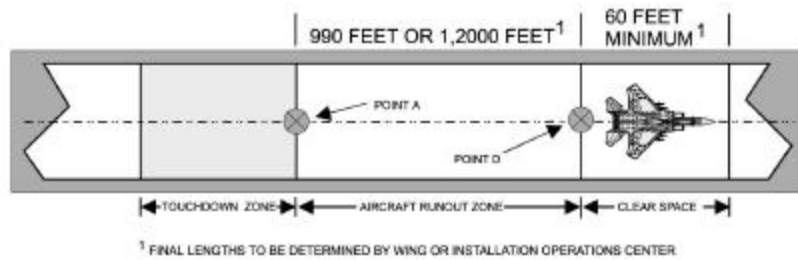
**NOTE:** Determine the configurations of the MAAS units, barrier tapes, and cables. **While MAAS units are supplied with 66-inch diameter tape storage reels, an individual MAAS unit may not have been upgraded to allow the full 1,200-foot aircraft runout zone.** If the system has been upgraded to accommodate the full 1,200 foot runout, it may have tapes cut shorter than required for your set-back situation, based on previous operational requirements at the deployment location. Determine the length of tape required, such as for use with the Lightweight or standard Fairlead beams. If already pre-cut for another length than what you need, then a new tape will be required.

Be aware that a MAAS may be located at the end of a runway, and may be required to catch an aircraft aborting a takeoff. As such, this *abort-end* MAAS may be required to catch an aircraft that is travelling at high speeds and mission takeoff weights. If this is a possibility, ensure that the MAAS is configured and installed per the T.O. requirements for heavier weight fighter aircraft. Also, ensure that there is an adequate runout zone for an abort-end engagement.

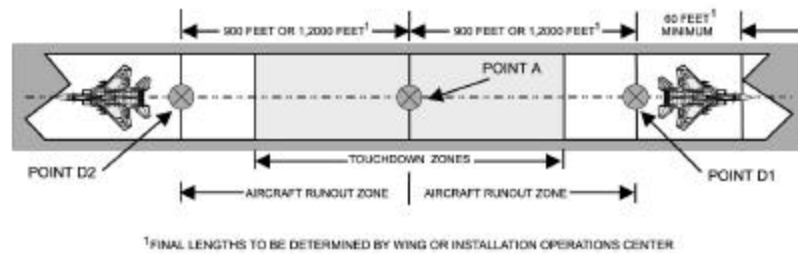
**Point D** (figure 7), the centerline point of the aircraft runout zone, must fall at a point on the paved surface. For bi-directional operations, there are two points, **Points D1** and **D2** (figure 8). **Point D** must be chosen to also allow for an **additional clear space** that is sufficient to remove an aircraft from the pavement in the event the aircraft must be towed clear of the runway or to allow it to turn around. This will also allow room for approach to a disabled aircraft by emergency and maintenance vehicles. Ensure that there is at least

an additional 60 feet of *clear space* pavement past **Point D**, unless instructed differently by Wing or Installation Operations Center personnel.

**Figure 7. Establishing Centerline Point D – Unidirectional Operation.**



**Figure 8. Establishing Centerline Points D1 and D2 – Bi-directional Operation.**



### **SITING THE EQUIPMENT**

The term "set points" is used to identify the locations where you want to set the runway edge sheaves for each MAAS and Fairlead beam for installation and operation. After determining whether or not a Fairlead beam is required and determining the operational cable length, locate the distance from the runway operating surface for the set points for each MAAS and Fairlead beam (if required for use).

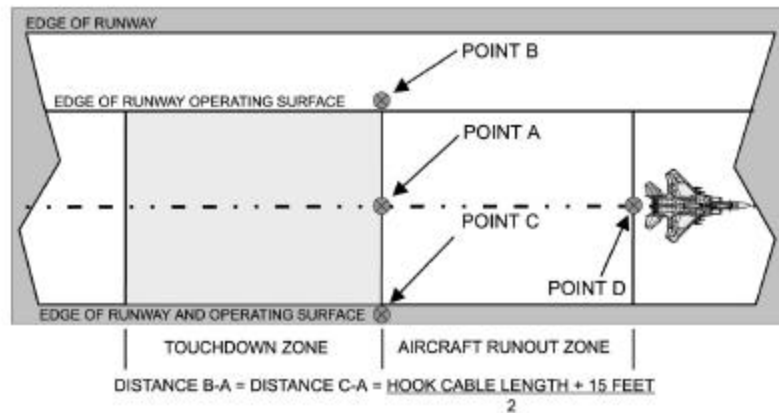
**Select the detailed instruction below on how to establish the set points for installation of a MAAS, MAAS with a Lightweight Fairlead beam, or a MAAS with a Standard Fairlead beam. Because the use of a MAAS with deadman anchors is rather unique, the siting instructions for the MAAS with deadman anchors is included with the installation instructions for that method.**

**MAAS:**

The distance from the center of the runway operating surface **Point A** to the front centerline of the runway edge sheave of each MAAS trailer (i.e., the **set Points B and C**) (figure 9) is one half the sum of the Hook Cable Length + 15 feet.

$$\text{Distance (B-A)} = \frac{\text{Hook Cable Length} + 15 \text{ Feet}}{2} = \text{Distance (C-A)}$$

**Figure 9. Establishing MAAS Set Points B and C.**



A line from **set Points B and C** is perpendicular to the line from **Points A to D**. **Points B, A, and C** are in a straight line. The units can be aligned by sight or by using a string line method.

**Align by sight:**

An experienced team member stands at **Point A** and determines the perpendicular line to the runway operating surface centerline **Points A** and **D**.

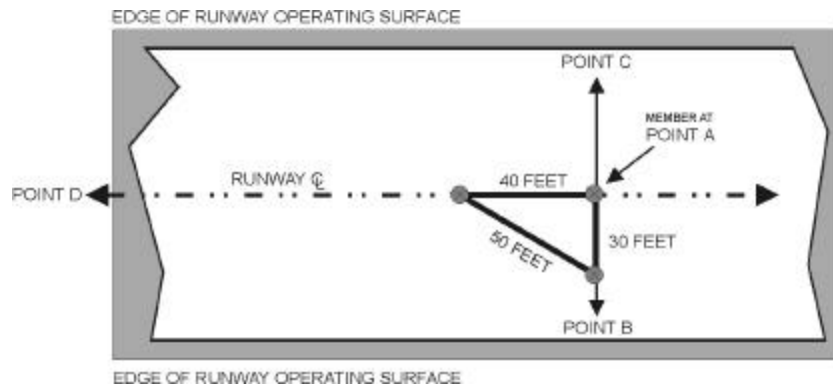
The team member holds one end of the tape and directs the alignment of **set Point B** at the distance **B-A**.

The **line B-A** is extended to the other side of the runway from **Point A** for a distance **C-A** to establish **set Point C**.

Check to ensure that **Points B, A, and C** are in a straight line.

**Align with string line method using three team members (figure 10)**  
**[THIS IS A TYPICAL METHOD, WHICH SHOULD BE FOLLOWED**  
**IN SUBSEQUENT INSTALLATION METHOD INSTRUCTIONS]:**

**Figure 10. Using String Line Method to Locate Points B and C – Typical Installation.**





Mark a heavy string line (with the distances marked on the string) for 40 feet plus 50 feet plus 30 feet, or use a flexible measuring tape (with at least 120 feet of length).

One member standing at **Point A** must hold **both ends** of the string or tape (at the 120-foot mark) just above the runway on **Point A**.

Two other members hold the string line or tape at the 40-foot mark and the 50-foot mark (or the 90-foot mark on the tape measure, if used).

The member with the 40-foot mark is aligned along the runway operating surface centerline toward **Point D**.

The third member with the 50-foot mark walks toward the side of the runway and the three team members hold the strings **equally taut** at an equal distance above the runway surface.

The direction along the 30-foot length of tape/string from **Point A** is the line perpendicular to the runway operating centerline.

Extend this direction from **Point A** to one side of the runway for the distance **B-A** to establish **set Point B**.

Extend this line in the other direction from **Point A** for the distance **C-A** to establish **set Point C**.

Check to ensure that **Points B, A, and C** are in a straight line.

**MAAS with Lightweight Fairlead beam (LWFB):**

For anchoring in soil or on a concrete runway, the distance from the center of the runway operating surface **Point A** to the front centerline of the runway edge sheave of each LWFB (i.e., the **set Points B** and **C**) is one half the sum of the Hook Cable Length + 15 feet.

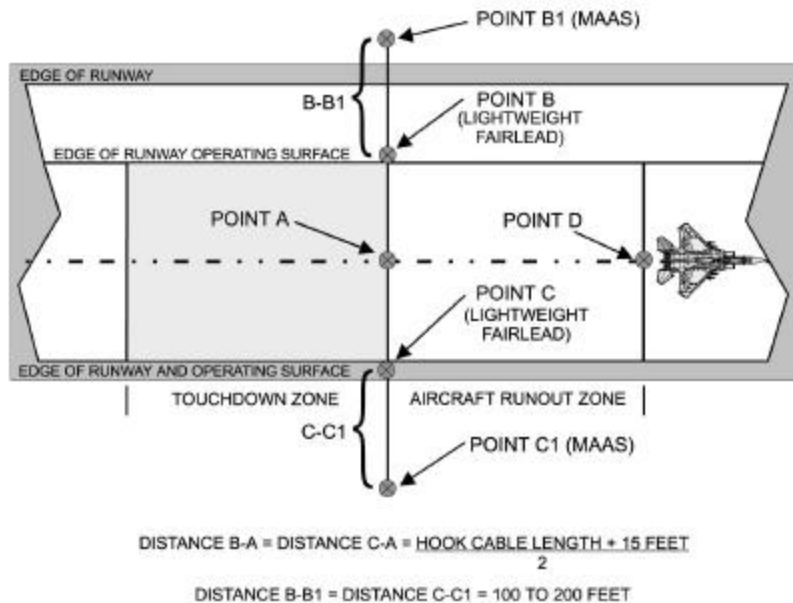
$$\text{Distance (B-A)} = \frac{\text{Hook Cable Length} + 15 \text{ Feet}}{2} = \text{Distance (C-A)}$$

**Example:** A 150-foot wide asphalt runway is planned for use with a 153-foot cable. The tape required for centering is 15 feet long. The Distances **B-A** and **C-A** should be 84 feet, which meets the at least 90% cable width criteria.

**Example:** A full 200-foot wide asphalt runway is planned for use with a 153-foot cable. The tape that would be required for centering is 47 feet long, which is greater than 15 feet and does not meet the at least 90% criteria, and also does not meet the 80% criteria for emergency situations. Either obtain a longer 195- or 205-foot cable or contact operational personnel/your control center to let them know that there is a conflict with the installation criteria.

The centerline of the LWFB is in line with the centerline of its front sheaves. Therefore, there is no offset between the MAAS units and the LWFBs. The MAAS is located at **set Points B1** and **C1** (figure 11) for the setback distances of **B-B1** and **C-C1**. These setback distances from the edge of the runway are equal and can be between 100 feet and 200 feet behind **set Points B** or **C**.

**NOTE:** For operational waiver purposes, a minimum 200-foot setback from the edge of the runway operating surface is required.

**Figure 11. Establishing MAAS and LWFB Set Points B, B1, C, and C1.****Align with string line method using three team members:**

Follow the typical string line installation method to establish **set Point B** for the LWFB. A small wooden stake or other marker should be temporarily set at this **set Point B**.

Extend this line in the other direction from **Point A** for the distance **C-A** to establish **set Point C** for the LWFB. A small wooden stake or other marker should be temporarily set at this **set Point C**.

**Note:** As with the MAAS installation at the edge of the runway, a trained, experienced team member may be able to establish **set Points B** and **C** near the edge of the runway without using a string line.

However, the following string line/tape steps must still be used for establishing the setback locations **B1** and **C1** for the MAAS trailers.

The team member at **Point A** aligns two personnel who pull a tape from **set Point B** for the setback distance **B-B1** to establish MAAS **set Point B1**. A small wooden stake or other marker should be temporarily set at this **set Point B1**.

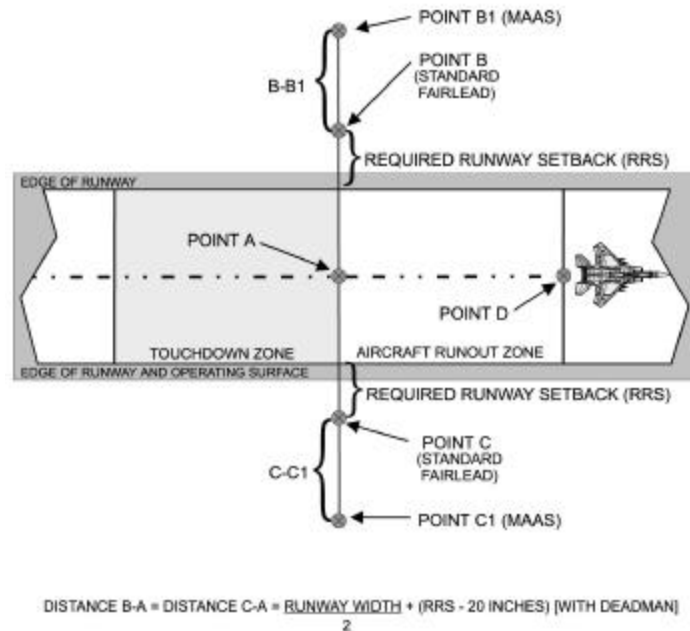
Repeat this step from **set Point C** to establish MAAS **set Point C1**. A small wooden stake or other marker should be temporarily set at this **set Point C1**.

IMPORTANT: Check to ensure that **Points B1, B, A, C, and C1** are in a straight line.

**MAAS with Standard Fairlead beam:**

For anchoring in soil, the distance from the center of the runway **Point A** to the standard Fairlead beams establishes the **set Points B** and **C** (figure 12) for the beams on both sides of the runway.

**Figure 12. Establishing MAAS and Standard Fairlead Beam Set Points B, B1, C, and C1.**



The standard Fairlead beam front measure point is the front of the lead sheave (for a two sheave standard Fairlead beam) or the front of the centerline between the two sheaves (for a three sheave standard Fairlead beam). This

distance is one half the Runway Width + the sum of the required runway setback (RRS) distance (Table 1) minus 20 inches (i.e., the distance between the front measure point of a standard Fairlead beam and a front anchor hole).

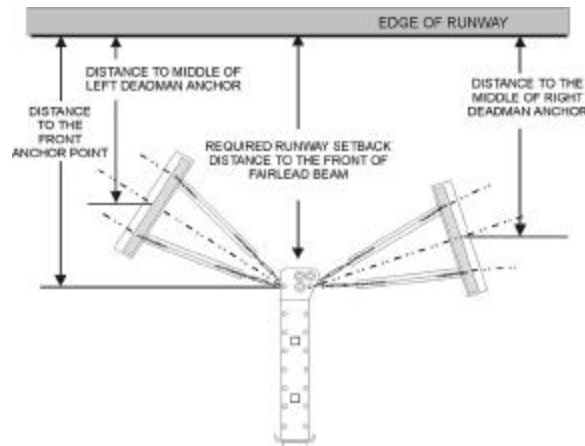
$$\text{Distance (B-A)} = \frac{\text{Runway Width}}{2} + (\text{RRS} - 20 \text{ inches}) = \text{Distance (C-A)}$$

**Table 1. Required Setback Distances.**

Runway Width	Distance to a front anchor point	Distance from runway edge to middle of left deadman anchor	Distance from runway edge to middle of right deadman anchor
<b>150 Feet</b>	20 '	12 ' 6 "	17 ' 6 "
<b>200 Feet</b>	13 '	5 ' 6 "	10 ' 6 "
<b>300 Feet</b>	13 '	5 ' 6 "	10 ' 6 "

The RRS is the distance normally required to install the deadman anchoring system from the edge of runway to the front anchor point of the standard Fairlead beam (figure 13). The RRS distance is based on the runway width and is normally set at either 13 feet or 20 feet. If site conditions require an adjustment to increase the RRS distance a few feet due to problems with excavation of the deadman near the runway or to protect the runway pavement system, both standard Fairlead beams should be adjusted equally. Again, the 90% cable length factor should be checked for this installation.

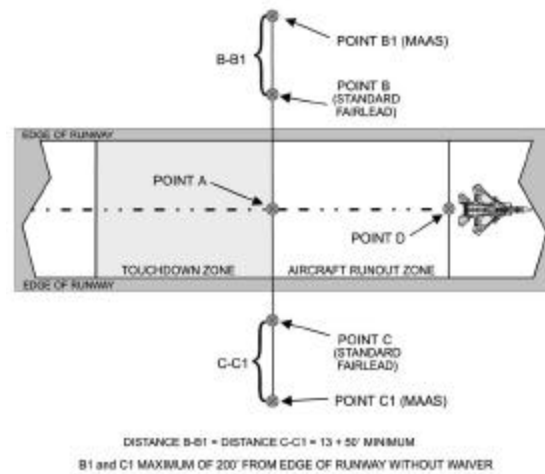
**Figure 13. Required Runway Setback for Deadman Anchors – Typical Layout.**



The standard Fairlead beam may be installed at the edge of the runway **using the LWFB 52-stake KM Anchoring Kit plus two additional stakes** (for the beam's two additional body stakeholders). [To be able to use this 52-stake KM Anchoring Kit, a set of standard Fairlead Beam Adapter Brackets **must be installed** at the lead-on (i.e., rear) sheave.]

The front centerlines of the runway edge sheaves of each MAAS trailer are **set Points B1 and C1**. The MAAS setback distance (i.e., **B-B1 and C-C1**) (figure 14) to the standard Fairlead beam edge sheaves is 13 feet plus a distance between 50 feet and 300 feet. [The standard Fairlead beam's nominal length to the edge sheave is 13 feet.]

**Figure 14. MAAS Setback Distances B1 and C1 from Standard Fairlead Beam.**



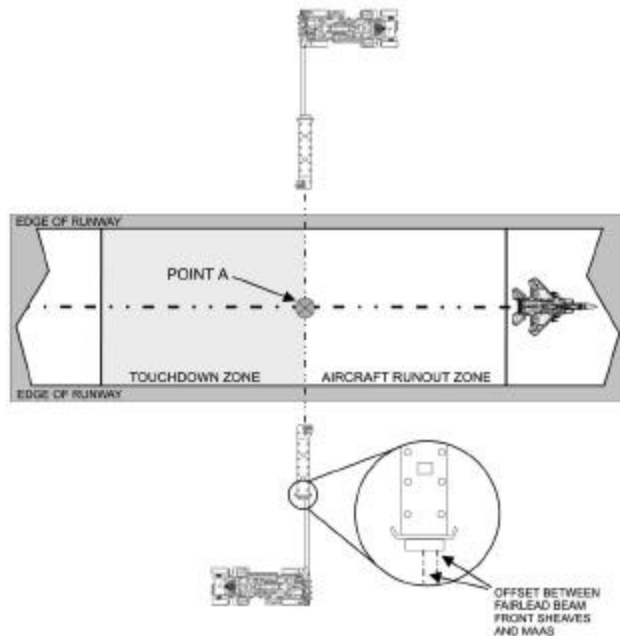
**NOTE:** While it is possible to install the MAAS up to 300 feet from the standard Fairlead beam, for practical purposes, limit the distances **B-B1** and **C-C1** to 200 feet from the edge of the runway operating surface. This will also reduce premature tape wear and minimize the need for extensive re-leveling of the ground surfaces between the MAAS and the standard Fairlead beam when there are variations in slopes within the runway lateral clearance distances.

**IMPORTANT:** The centerline of the standard Fairlead beam lead-on sheaves is off set from the front of the beam's edge sheaves. This off-set is approximately 20 1/4 inches for a two sheave standard Fairlead beam and by approximately 9 9/16 inches for a three sheave standard Fairlead beam. Therefore, to keep each MAAS unit aligned with the standard Fairlead beam's lead-on sheave, **you must off set the MAAS units (figure 15).** When looking at the MAAS units from **Point A**, the MAAS units will have an **off-set to the right of the arresting cable.** This off-set is either 20



1/4 inches or 9 9/16 inches, based on whether the standard Fairlead beam has two or three sheaves respectively.

**Figure 15. MAAS Offset from Standard Fairlead Beam Front Sheave Centerline.**



Alignment of the MAAS units and the standard Fairlead beams usually requires the use of an engineering technician and a transit. Aligning the MAAS units and standard Fairlead beams using a string line method could be accomplished under only ideal conditions if **set Points B1 and C1** are 200 feet from the edge of the edge of the runway operating surface. For set back

distances that must be greater than 200 feet or when conditions are windy and/or a string line can not be held taut and straight, use engineering personnel and a transit.

**Align with a transit:**

Determine which standard Fairlead beams are to be used. A two sheave standard Fairlead beam requires a 20 1/4 inch offset, while a three sheave standard Fairlead beam requires a 9 9/16 inch offset. Use either the T.O. method or this method, depending on the surveying equipment and personnel available for support of the layout.

Set up the transit at **Point A** on the runway operating surface centerline and align with **Point D**.

Turn the transit 90 degrees to establish a perpendicular line to the runway operating surface centerline.

Pull a measuring tape from **Point A** for the distance **B-A** and align the **set Point B** on the perpendicular line.

Temporarily set a small wooden stake or other marker to establish **set Point B**. Measure off the required offset to the surveyor's right and set another temporary wooden stake or marker.

Pull a measuring tape from **set Point B** for the distance **B1-B**, keeping it aligned on the perpendicular line from **Point A**.

Temporarily set a small wooden stake or marker at this point. Measure off the required offset to the surveyor's right and set another temporary wooden stake or marker to establish **set Point B1** for the centerline of the MAAS lead-off sheaves.

Turn the transit 180 degrees to establish the perpendicular line to the other side of the runway operating surface.

Pull a measuring tape from **Point A** for the distance **C-A** and align the **set Point C** on the perpendicular line.

Temporarily set a small wooden stake or other marker to establish **set Point C**. Measure off the required offset to the surveyor's right and set another temporary wooden stake or marker.

Pull a measuring tape from **set Point C** for the distance **C1-C**, keeping it aligned on the perpendicular line from **Point A**.

Temporarily set a small wooden stake or marker at this point. Measure off the required offset to the surveyor's right and set another temporary wooden stake or marker to establish **set Point C1** for the centerline of the MAAS lead-off sheaves.

**Align with string line method using three team members:**

Follow the typical sting line installation method to establish **set Point B** for the standard Fairlead beam. A small wooden stake or other marker should be temporarily set at this **set Point B**.

Extend this line in the other direction from **Point A** for the distance **C-A** to establish **set Point C** for the standard Fairlead beam. A small wooden stake or other marker should be temporarily set at this **set Point C**.

The team leader at **Point A** faces **set Point B** and directs the person at that point to measure off the required offset to the team leader's right and set another temporary wooden stake or marker.

The team leader at **Point A** aligns the person at **set Point B** with a second person to pull a tape for the setback distance **B-B1** to establish the MAAS setback. Temporarily set a small wooden stake or marker at this point.

The team leader at **Point A** directs the person at that point to measure off the required offset to the team leader's right and set another temporary wooden stake or marker to establish **set Point B1** for the centerline of the MAAS lead-off sheaves.

The string team moves to the other side of the runway back to **set Point C**.

The team leader at **Point A** faces **set Point C** and directs the person at that point to measure off the required offset to the team leader's right and set another temporary wooden stake or marker.

The team leader at **Point A** aligns the person at **set Point C** with a second person to pull a tape for the setback distance **C-C1** to establish the MAAS setback. Temporarily set a small wooden stake or marker at this point.

The team leader at **Point A** directs the person at that point to measure off the required offset to the team leader's right and set another temporary wooden stake or marker to establish **set Point C1** for the centerline of the MAAS lead-off sheaves.

**NOTE:** When placing or positioning the standard Fairlead beam prior to final anchoring, the beam's alignment can be checked with the MAAS by using a transit or a string line. Run a string line from the temporary stake/mark next to **set Point B** (or **set Point C**, as applicable) to the temporary stake/mark at the MAAS **set Point B1** (or **set Point C1**, as applicable). The beam will be parallel to and centered under the string line.

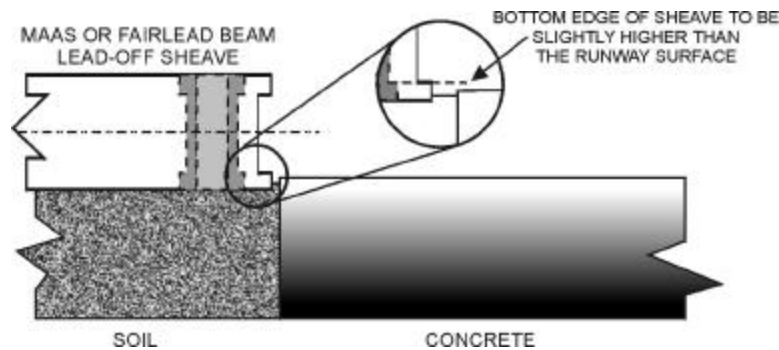
## SITE PREPARATIONS

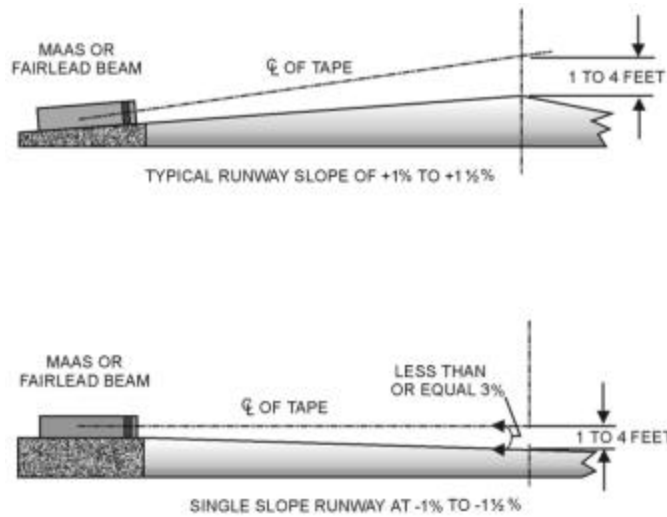
### Alignment and Clearing

It may be necessary to perform minor leveling of the ground surface around and under the MAAS and/or the LWFB or standard Fairlead beams to ensure that there is no interference with the tape path. **The edge of the runway surface must not extend higher than the MAAS or Fairlead beam sheave** (figure 16). Additional fill, leveling, and compaction are required to bring the runway shoulder to an acceptable grade if it is lower than the runway surface. Remember to always check that the MAAS units have the correct tape length to allow their use with Fairlead beam set backs, such that the 990-foot or the 1,200-foot aircraft runout zone can be provided.

It is desirable that the tape centerline projection from the MAAS's deck sheave or the LWFB or standard Fairlead beam's sheave adjacent to the runway (figure 17) is angled to project through a window 1 to 4 feet above the runway crown. (Exception: The projection should be above the centerline of the runway operating surface when the runway operating surface is offset to one side of the crown).

**Figure 16. Bottom of Edge Sheave Equal or Above Pavement Surface.**



**Figure 17. Projection of Tape Centerline Above Runway.**

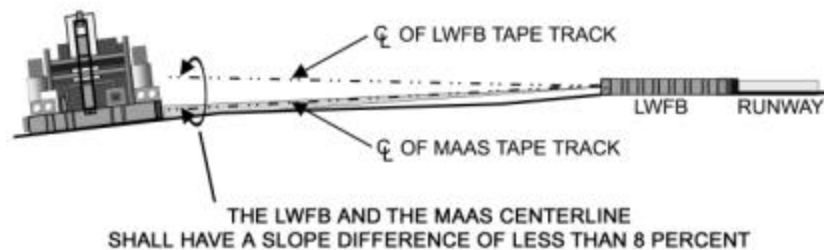
The slope of the tape centerline projection must not exceed the runway slope by more than 3% on runways up to 200 feet wide. The slope must not exceed the transverse slope by more than 2.3% for runways up to 300 feet wide.

**Example:** The tape projection from a standard Fairlead beam is 4 feet above the centerline/crown of a 300-foot wide runway. The standard Fairlead beam is located 13 feet from the edge of the runway. The tape projection exceeds the runway transverse slope by  $4 / (150 + 13) = .0245 = 2.45\%$ , which is greater than the 2.3% criteria. The area around the standard Fairlead beam needs to be leveled to bring the taper projection down.

The MAAS must be level with or lower than the rear of the LWFB or standard Fairlead beam to prevent any lifting action on the rear of the LWFB or standard Fairlead beam as the tape becomes taught during aircraft

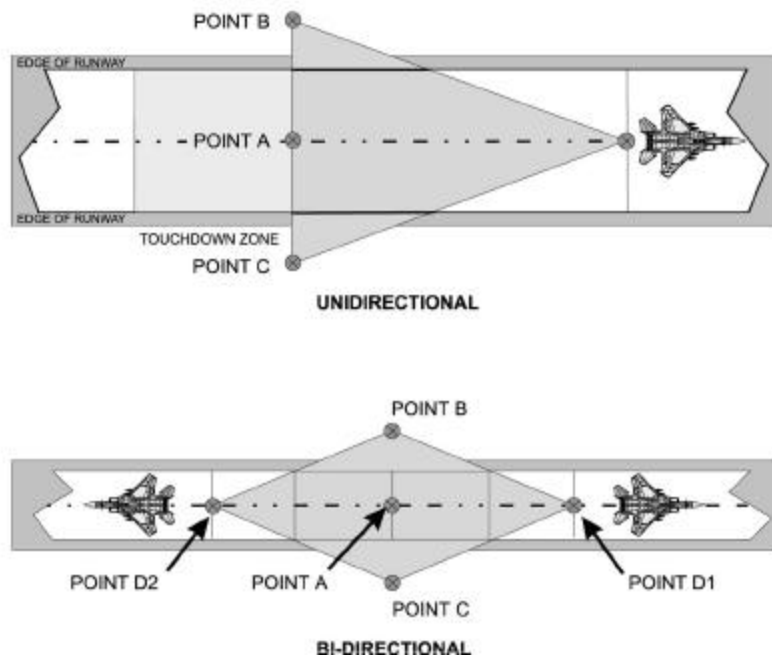
engagement. Therefore, the MAAS must always be located such that the angle (of decline) created between the tape from the rear of the LWFB or standard Fairlead beam to the trailer runway edge sheaves is minimal (figure 18). The difference in slope of the tape from the MAAS with the centerline of the Fairlead beam tape track is less than 8 percent.

**Figure 18. Angle of Decline Between MAAS and the Fairlead Beam.**



Angle the MAAS and the LWFB or standard Fairlead beam such that the projected tape path **does not interfere** with the ground or runway surface.

The area formed by **Points B, C, and D** (or **Points B, C, D1, and D2** for bi-directional operation) is the Tape Sweep Area (figure 19). This area must be cleared of all obstructions and sharp objects, such as stones and airfield lighting fixtures. For rapid installation, additional heavy equipment personnel and equipment should be used while the arresting system is being installed.

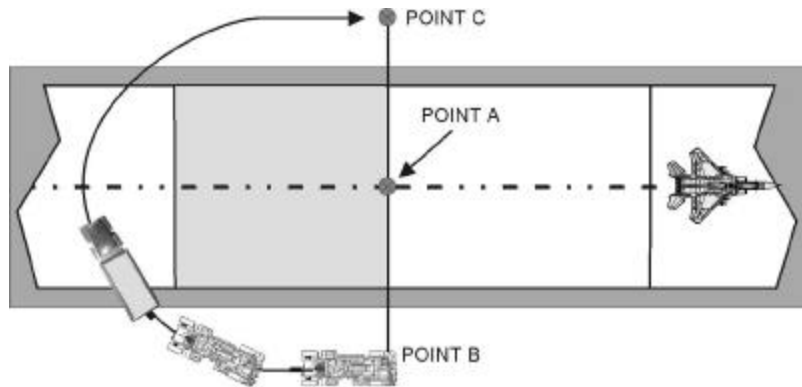
**Figure 19. Tape Sweep Areas to Be Cleared.****Position the Trailers**

The MAAS units are towed together parallel to the direction of the runway operating surface. Approach the runway with the centerline to the driver's right; this allows the deck sheave to be in the correct position facing the runway. Drop one unit at **Point B** (or **Point B1** if a LWFB or Fairlead beam is used). Position the unit such that the leading edge of the runway edge sheave (located behind the right rear wheel on the trailer) faces the runway operating surface. Pull the other trailer around in an arch (figure 20). Drop it



at the other side of the runway operating surface, positioned such that the leading edge of the runway edge sheave is at **Point C** (or **Point C1** if a LWFB or standard Fairlead beam is used). Both MAAS trailers should be parallel and facing in opposite directions.

**Figure 20. Positioning the MAAS Trailers.**



**NOTE:** To avoid large movements of the MAAS trailer when lowering, use the following procedure. Align the right-rear vertical reflector face of the MAAS trailer (near the runway edge sheave) over the set point. Set the brake. Then lower the MAAS unit. This should keep the trailer within a couple of inches of the required location.

**No part of the trailer or anchoring system should extend into the tape sweep area.**

**Disconnecting:**

Lower the tow bar swivel jack on the towbar assembly.

Set the trailer's parking brake.

Disconnect the trailer from the prime mover.

Remove the trailer cover (and store when time permits).

Remove the runway edge sheave guard (and store when time permits).

**NOTE:** When a soil installation will be used, remove the nine moil point bushings, and the rear stake storage brackets; store when time permits.

**General Cautions:**

Never attempt to raise or lower on a steep incline.

Ensure that the surface is smooth, flat, and clear of any foreign body or sharp objects.

Remove the front storage box lid and store temporarily away from the trailer. Failure to remove the lid can cause the 90-degree hydraulic elbow to break off during lowering operations. Resecure when time permits after lowering and installation of the MAAS.

Clear all unnecessary personnel from around the trailer unit.

**Connect the HPU to the trailer.**

Connect the right side HPU hose to the quick disconnect block behind the HPU on the trailer. Ensure that the quick disconnect fittings are clean before connecting.

**CAUTION:** Use the same HPU to lower and raise the MAAS trailer to prevent transfer of hydraulic fluid between HPU reservoirs. If it becomes necessary to use another HPU, adjust the fluid levels to avoid damage.

Start the HPU following technical order/published procedures.

Raise the trailer by placing the control valve in a “raise trailer” position to relieve the pressure on the pins.

Remove the four axle-frame retaining pins. Two pins are located on the front of each axle support frame. Store the pins in the front storage box.

**CAUTION:** Never place the control valve in the "lower trailer" position with one pin installed. At no time should an axle frame be left with only one pin installed for an extended time. Damage to the axle support frame could result.

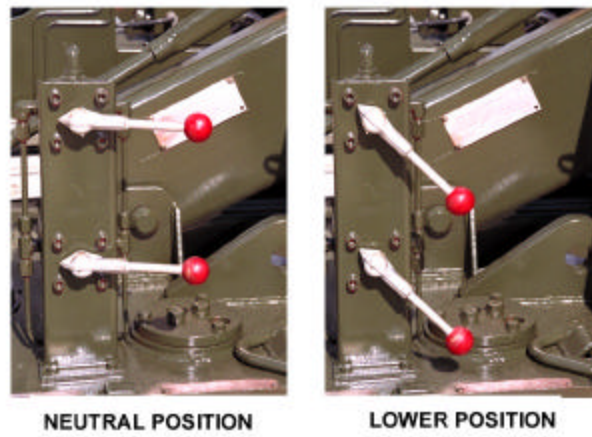
**WARNING:** Keep feet and hands away from the axle frames and trailer bottom during lowering operation. Ensure that there is no equipment or other obstruction under the trailer.

Place the control valves in the "lower trailer" position (figure 21).

Lower trailer until the unit is solidly on the ground or pavement surface. **If during the lowering operation the trailer moves off its set point,** stop the lowering operation before the unit contacts the ground surface. Raise the unit, replace the pins, release the brake and reposition the trailer. Repeat the above steps for lowering the trailer and continue lowering to the surface.

**NOTE:** When lowering the MAAS for installation **on level pavement** and the trailer moves off of the set point, then it may be possible to stop the trailer prior to contacting the ground and then reposition it. Stay clear of the underside of the trailer while moving it and do this only on level ground.

When the axles are in the fully raised position, return the control valves to their neutral position.

**Figure 21. Lever Position for Lowering the MAAS**

## DETAILED INSTALLATION PROCEDURES

Two installation methods are used repeatedly throughout this handbook, the KM stake line method and the concrete anchor plate method. The **step-by-step installation procedures** for both are described below and **remain the same for the various typical system installations, unless specifically noted** in the system installation text.

### KM Stake Line Method:

This method is used with two, three, or four stakes in a straight stake line. They vary only in the number of stakes and stake spacers used and whether the installation is on asphalt-over-soil or a soil installation. The basic steps are:

Remove the required installation tools, hardware, and the work stands stored on each trailer. Assemble the work stands if to be used with the hydraulic breakers and the drive shank and stake driver.

**GENERAL NOTE:** When a MAAS trailer has received **the ETL 98-10 upgrade, it will have the Stanley stake driver, which is an integral unit and does not require the use of a drive shank and stake driver.** Throughout the following instructions, when mention is made of using a hydraulic breaker with a drive shank and stake driver, an integral Stanley stake driver may be used in lieu of the a hydraulic breaker.

If the installation is asphalt-over-soil, then install the digging chisels on the hydraulic breaker units.

Connect the hydraulic breakers to the 50-foot hoses attached to the HPU's. Ensure that the quick disconnect fittings are clean before connecting.

Adjust the turnbuckle that will be used for the connection so that there is approximately 36 inches between the centers of the two clevis pins.

Attach the turnbuckles to the appropriate anchor point connections, which may have a triple-turnbuckle fitting installed on the MAAS, LWFB, or standard Fairlead beam.

**NOTE:** The locknut end of the turnbuckle is always toward the MAAS trailer or the other equipment that is being installed.

Start the HPUs, per normal operating procedures.

**General Instruction:** The 66 inch long stakes are painted green on the top 18 inches of stake to indicate the recommended driving depth. The anchoring systems are designed to be driven 48 inches into the ground (i.e., drive until the painted surface contacts the ground). If the stakes are not painted, then make sure that the stakes are driven 48 inches. The stake must be driven to at least a 36-inch depth to be acceptable. If a stake hits an obstruction and cannot be driven to the minimum 36-inch depth, then the stake line must be moved. Each KM anchoring stake configuration (table 2, figure 22) is based on the size of the stake line.

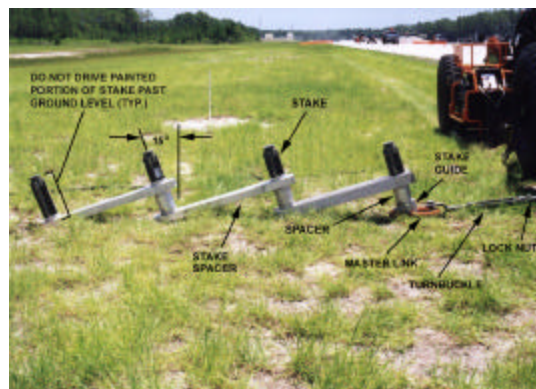
**Table 2. Stake Line Components.**

Stake Line Size	Turnbuckle, Master Link, and Stake Guide	Spacers (or Spacer Rings)	Stake (Tie) Spacers
<b>2 stake</b>	1 each	1 each	1 each
<b>3 stake</b>	1 each	2 each	2 each
<b>4 stake</b>	1 each	3 each	3 each

The work stand may be required while driving the stakes if a hydraulic breaker is used in lieu of the Stanley stake driver upgrade. A third person is usually required to steady the stand and the operator during use of the hydraulic breaker.

Install the master link around the stake guide (figure 23) and attach the free end of the master link to the turnbuckle (figure 24).

**Figure 22. 4-Stake KM Stake Line.**



**Figure 23. Master Link and Stake Guide.**



**Figure 24. Turnbuckle Attached to Master Link.**

Pull the stake guide and turnbuckle tight to locate the first stake (figure 25).

**Figure 25. Locating the Stake.**



If the installation is asphalt over soil:

Mark the pavement using the inside diameter of the stake guide. Remove the marked asphalt using the digging chisels on the hydraulic breakers. Make sure that the side of the hole closest to the trailer has a vertical straight edge cut (figure 26).

**NOTE:** This method should not be used when the asphalt is greater than 12 inches deep. This method may not be effective when the depth of the asphalt is between 6 and 12 inches deep if the hole can not be readily chiseled to the diameter of the stake (with or without weakening the strength of the base materials). If either of these two conditions exist, move the MAAS installation off the asphalt over soil surface.

**Figure 26. Asphalt Removal at Stake Location.**



Remove the digging chisel on the hydraulic breaker.

Install the drive shank and stake driver on the hydraulic breaker.

Install and drive a stake (figure 27) through the stake guide. The initial, and all subsequent stakes, should be driven at approximately a 15° angle away from the MAAS trailer. If stakes are not driven at the same angle, then removal of the stake spacers becomes extremely difficult and damage to equipment and injury to personnel could occur while trying to force the components apart during tear down. Do not drive the 18-inch painted portion at the top of the stake past ground level.

**Figure 27. Driving a Stake with Hydraulic Breaker.**



**NOTE:** Make sure to orient the stakes (figure 28) such that the stake body puller can grasp them during removal operations. With MAAS trailers equipped with the Stanley equipment upgrades, the Stanley stake

puller requires a different stake orientation (TOP OF PHOTO) then the current hydraulic ram stake puller (BOTTOM OF PHOTO).

**Figure 28. Stake Orientation on Stake Spacer.**



Install a spacer over the stake and rest it on the stake guide (figure 29).

**Figure 29. Install a Spacer (Ring) on the Stake.**



Install a stake spacer over the stake and rest it on the first spacer (figure 30).

**Figure 30. Install a Stake (Tie) Spacer on the Stake.**



The centerline of the stake spacer must be in line with the turnbuckle (figure 31).

The free end of the stake spacer locates the next stake. If the installation is asphalt over soil, then reinstall the digging chisel, mark the pavement inside the stake spacer. Remove the marked asphalt using the digging chisel to expose the soil base.

Install the next stake through the end of the stake spacer. The stake should be driven in at approximately a 15° angle away from the MAAS trailer. Do not drive it past the 18-inch painted portion at the top of the stake.

**Figure 31. Maintain a Straight Stake Centerline for the Next Stake.**



For a three or four stake installation, repeat the above stake locating and installation steps for each new stake. Continue maintaining the centerlines (figure 32) of the stake spacers in line with the turnbuckle.

**Figure 32. Maintain Alignment with Subsequent Stakes.**



**Concrete Anchor Plate Method:**

The basic steps to install the anchor plates with six 1-inch diameter bolts are:

Install the drill bit in the hydraulic hammer drill.

Connect the hydraulic hammer drills to the 50-foot hoses attached to the HPUs. Ensure that the quick disconnect fittings are clean before connecting.

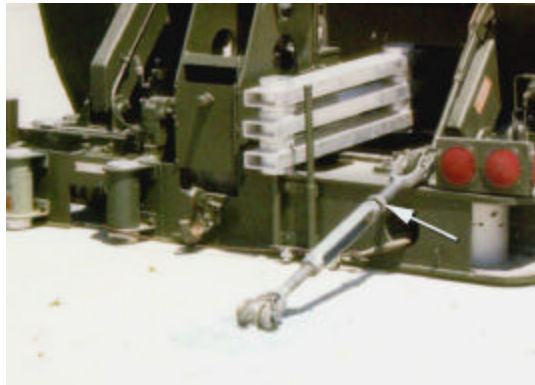
Adjust the two turnbuckles that will be used for the connection so that there is approximately 39 inches (figure 33) between the centers of the two clevis pins.

**Figure 33. Adjust Turnbuckles to 39-Inch Length.**



Attach the locknut end of the turnbuckle to the designated anchor point. [Note: The use of a triple turnbuckle fitting may be required for additional clearance when anchoring near the right rear anchor point. See specific installation procedure in following sections.] **The locknut end of the turnbuckle is always installed toward the equipment being anchored** (figure 34).

**Figure 34. Locknut End Always Toward the Anchored Equipment.**



Attach the other end of the each turnbuckle to an anchor plate and align the plate (figure 35). The anchor plate has the anchor connection point closer to one end of the plate than the other. **The short end is always attached to the turnbuckle and located toward the equipment being anchored** (see Figure 36 for depiction of short end).

**Figure 35. Align Plate.**



After starting the HPUs, use each anchor plate as a template to drill six 1-inch diameter holes to a depth of 6.5 inches. To maintain the plate position during drilling, and to avoid having drilling debris fill other holes, insert a taper bolt with washer and nut into each hole as it is drilled (figure 36). Insert each bolt to approximately 1/2 of the bolt length.



**Figure 36. Partially Install Bolts as Each Hole is Drilled.**



If there is a thin asphalt overlay (of 1 inch or less), then drill through the asphalt and 6 inches into the concrete. Six anchor bolts are required per each plate.

After shutting down the HPU, adjust the taper nut such that inserting to depth requires tapping with a 4-pound hammer. Seat all taper bolts and nuts using the hammer and taper bolt gauge to obtain the required 3/8-inch clearance between the bolts head and the anchor plate.

Tighten down all bolts.

Tighten the turnbuckle to remove slack, but do not over-tighten enough to cause the MAAS trailer or the LWFB to move. Ensure that the turnbuckles are tightened in tension and not by being expanded, since expanding the turnbuckles will give a taut effect.

Tighten the locknuts on the turnbuckles.

Store all the installation tools upon completion.

**SYSTEM INSTALLATIONS**

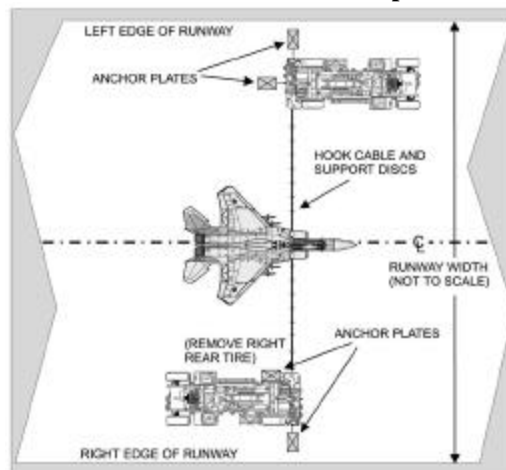
Following are various typical system installations for MAAS, LWFB, and standard Fairlead beam. Each section is complete for the type of installation required. Select from the installation methods (shown in the Table of Contents) and **use only the sections that apply to your specific installation situation.**

**CAUTION:** Unless specifically mentioned that a KM Stake Line Installation method is approved for heavier weight fighter aircraft, then the KM anchoring system is limited to a 40,000-pound aircraft engaging at 150 knots.

**MAAS on Concrete (or a concrete runway with thin asphalt overlay) -- Unidirectional Operation:**

Installation of the MAAS on this type runway surface (figure 37) is accomplished by installing two anchor plates to the runway and attaching the plates to the MAAS with turnbuckles. The anchor mechanism is with 1-inch diameter anchor bolts with a tapered nut. All tools and anchoring hardware for this installation are stored on each MAAS unit. This installation method can support heavier weight fighter aircraft operations.

**Figure 37. MAAS on Concrete – Unidirectional Operation.**



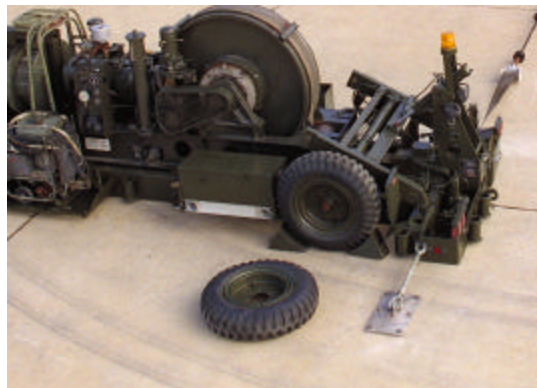
**NOTE:** The designation for the sides of the runway is based on the aircraft's direction of approach – which is the pilot's directions of left and right. The installation procedure is different for the MAAS trailer located on the right side of the runway. Due to the location of the runway side anchor point, the right rear tire of the MAAS (on the right side of the runway) must be removed prior to installing the anchor plate. This is due to the anchor plate being located in the area under and near the right wheel assembly (figure 38).

**Figure 38. Anchor Connection at Right Rear Wheel.**



At least two people should always work on and remove the wheel, which weighs 410 pounds. Rethread the lug nuts on the wheel studs after the wheel is removed. Store the wheel at the side of the MAAS (figure 39) away from the runway.

**Figure 39. Store Tire Away from Runway – Right MAAS Trailer.**



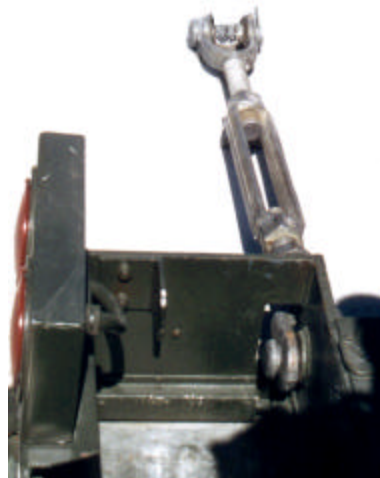
At least a 4-person team, made up of two 2-person teams, is assigned to anchor each MAAS trailer. Each 2-person team is assigned to a hydraulic power unit (HPU) on one side of the trailer and proceeds to anchor the anchoring plate on their side of the trailer with anchor bolts. Once one trailer is installed, then the 4-person team moves to the other side of the runway and installs the other trailer using the same procedures.

**Basic Steps for Installation:**

With the trailers positioned and lowered, remove the required installation tools and hardware stored on each trailer.

Install the two turnbuckles that will be used for the connection at the two designated anchor points on each MAAS trailer (figures 40, 41, and 42). Note: The left rear anchor point may also be referred to as the pretension anchor point.

**Figure 40. Left Rear Anchor Point with Turnbuckle – Both MAAS Trailers**



**Figure 41. Right Rear Anchor Point with Turnbuckle – Left MAAS Trailer**



**Do not actually install the turnbuckle on the right rear wheel anchor point until you determine that there is enough clearance to allow use of the installation tools. Figure 42 just shows the conflict between the turnbuckle, the anchor point, mud flap, and wheel hub.**

**Figure 42. Right Rear Wheel Anchor Point – Right MAAS Trailer**



**NOTE:** When the right rear wheel of the MAAS trailer is removed, a **triple-turnbuckle fitting can be installed on the right rear wheel anchor point of the MAAS trailer prior to installing the turnbuckle** (figure 43). This will provide additional clearance from the wheel brake drum during drilling. Even with the additional clearance under the right rear wheel brake drum, installation of the anchor plate may also require removing the rear portion of the cruciform stake storage rack bracket (figure 44) to allow installation of the two anchor bolts farthest away from the turnbuckle.

**Figure 43. Right Rear Wheel Anchor Point Using a Triple Turnbuckle Fitting and Turnbuckle – Right MAAS Trailer.**



Install the plates following normal installation procedures.

**CAUTION:** All six anchor bolts are required and must be installed to provide a safety margin for use. **If the installation of the MAAS is an emergency installation** where time is critical and if there is a problem with installation of the anchor bolts (such as hitting rebar), then a minimum of four properly installed bolts will meet an arrestment load for a 40,000-pound aircraft engaging at 150 knots. When time permits, install the remaining bolts. **There is no T.O. certified emergency**

installation for heavier weight fighter aircraft; all six bolts are required.

**Figure 44. Additional Clearance Using Triple Turnbuckle.**



When both plates have been anchored and turnbuckles tightened, then tighten the locknuts on the turnbuckles.

Repeat the actions for the trailer on the other side of the runway.

**Basic Steps for Readyng the MAAS:**

While each MAAS trailer is being installed, unless personnel are required to assist in the installation of the trailers, remove the hook cable from its storage reel and drag it across the runway.

**NOTE:** If hook cables have been prepositioned at the base location and are to be used instead of the 90-foot and 153-foot hook cables supplied with the MAAS, then the prepositioned cable must be brought to the site, prepared for use (to include placing support discs on cable), and dragged across the runway.



Pull out enough slack in the tape system to enable the hook cable to be attached to the tape connectors. This slack may be obtained by pulling the tape out of the trailer using two or three personnel or by connecting the tape to a vehicle. Ensure that the shuttle valve on the BAK-12 is in the OFF position for this operation. If a LWFB or Standard Fairlead beam is being installed with the MAAS, pull out the tape, reeve the beams, and install the tape connectors.

Attach the ends of the hook cable to the tape connectors.

Evenly space the support discs on 8- to 10-foot centers along the length of the barrier hook cable. Avoid placing a support disc at the centerline of the runway operating surface.

Confirm that all anchor plates are installed, tightened, and inspected on both trailers. Start the BAK-12 rewind engine, per normal operating procedures.

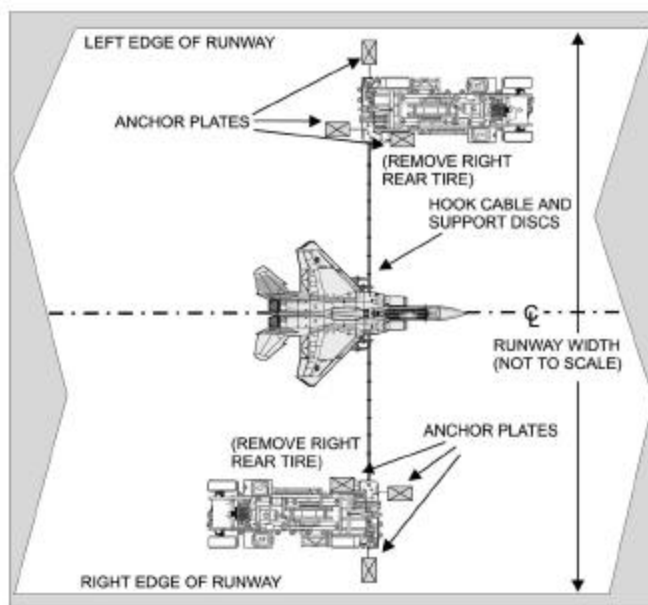
Pretension the hook cable, per normal operating procedures.

Shut down the BAK-12 rewind engine.

**MAAS on Concrete (or a concrete runway with thin asphalt overlay) -- Bi-directional Operation:**

Installation of the MAAS on this type runway surface (figure 45) is accomplished by installing three anchor plates to the runway and attaching the plates to the MAAS with turnbuckles. The anchor mechanism is with 1-inch diameter anchor bolts with a tapered nut. Upon completion of kit upgrades, the third Concrete Installation Kit and all tools and anchoring hardware for this installation will be stored on each MAAS unit. If the additional Concrete Installation Kit is not on the MAAS trailers, then the kits must be obtained separately to allow bi-directional installation. This installation method can support heavier weight fighter aircraft operations.

**Figure 45. MAAS on Concrete – Bi-directional Operation.**



**NOTE:** The installation procedure for a bi-directional installation requires that the **right rear tire of each MAAS trailer** must be removed prior to installing the anchor plate. This is due to the anchor plate being located in the area under and near the right wheel assembly (figure 46).

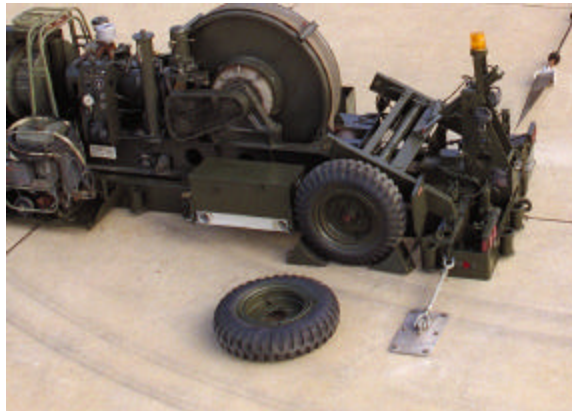
**Figure 46. Anchor Plate Connection at Right Rear Wheel.**



At least two people should always work on and remove the wheel, which weighs 410 pounds. Rethread the lug nuts on the wheel studs after the wheel is removed. Store the tire at the side of the MAAS away from the runway (figure 47) and rethread the lug nuts on the wheel studs.

At least a 4-person team, made up of two 2-person teams, is assigned to anchor each MAAS trailer. Each 2-person team is assigned to a hydraulic power unit (HPU) on one side of the trailer and proceeds to anchor the anchoring plate(s) on their side of the trailer with anchor bolts. Since there are three plates involved in this installation, one 2-person team will complete the installation of one plate and can move to the other trailer while the second 2-person team is completing the installation of their second plate on the first trailer.

**Figure 47. Store Tire Away from Runway – Both MAAS Trailers.**

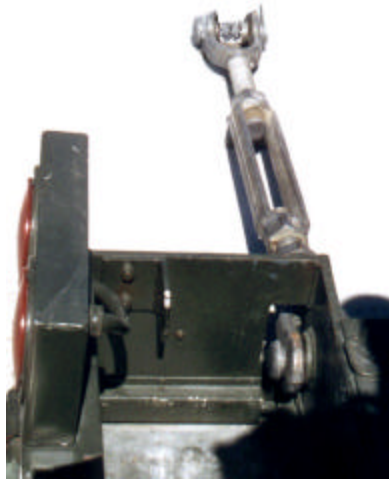


**Basic Steps for Installation:**

With the trailers positioned and lowered, remove the required installation tools and hardware stored on each trailer.

Install the three turnbuckles at the three designated anchor points on each MAAS trailer (figures 48, 49, and 50). Note: The left rear anchor point may also be referred to as the pretension anchor point.

**Figure 48. Left Rear Anchor Point with Turnbuckle – Both MAAS Trailers.**



**Figure 49. Right Rear Anchor Point with Turnbuckle – Both MAAS Trailers.**



**Do not actually install the turnbuckle on the right rear wheel anchor point until you determine that there is enough clearance to allow use of the installation tools.** Figure 50 just shows the conflict between the turnbuckle, the anchor point, mud flap, and wheel hub.

**Figure 50. Right Rear Wheel Anchor Point – Both MAAS Trailers.**



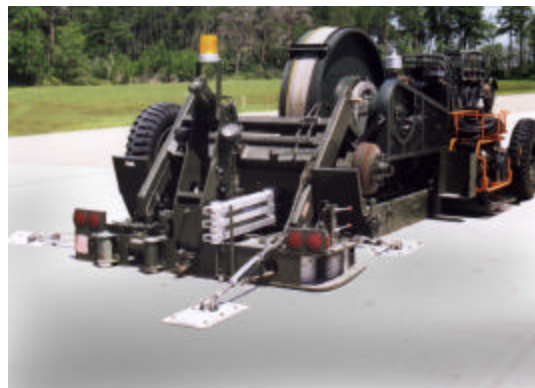
**NOTE:** When the right rear wheel of the MAAS trailer is removed, a triple-turnbuckle fitting can be installed on the right rear wheel anchor point of the MAAS trailer prior to installing the turnbuckle (figure 51). This will provide additional clearance from the wheel brake drum during drilling. Even with the additional clearance under the right rear wheel brake drum, installation of the anchor plate may require removing the rear portion of the cruciform stake storage rack bracket to allow installation of the two anchor bolts farthest away from the turnbuckle.

Both trailers are installed using the same procedures and locations (figure 52).

**Figure 51. Right Rear Wheel Anchor Point with Triple-Turnbuckle Fitting and Turnbuckle – Both MAAS Trailers.**



**Figure 52. Typical Anchor Plate Location For Bi-directional Installation.**



Install the plates following normal installation procedures.

**CAUTION:** All six anchor bolts are required and must be installed to provide a safety margin for use. **If the installation of the MAAS is an emergency installation where time is critical,** and if there is a problem with installation of the anchor bolts (such as hitting rebar), then a minimum of four properly installed bolts will meet an arrestment load for a 40,000-pound aircraft engaging at 150 knots. When time permits, the system should be upgraded to full capacity with six bolts per anchor plate. **There is no T.O. certified emergency installation for heavier weight fighter aircraft; all six bolts are required.**

When all three plates have been anchored and turnbuckles tightened, then tighten the locknuts on the turnbuckles.

Repeat the actions for the trailer on the other side of the runway.

#### **Basic Steps for Readyng the MAAS:**

While each MAAS trailer is being installed, unless personnel are required to assist in the installation of the trailers, remove the hook cable from its storage reel and drag it across the runway.

**NOTE:** If hook cables have been prepositioned at the base location and are to be used instead of the 90-foot and 153-foot hook cables supplied with the MAAS, then the prepositioned cable must be brought to the site, prepared for use (to include placing support discs on cable), and dragged across the runway.

Pull out enough slack in the tape system to enable the hook cable to be attached to the tape connectors. This slack may be obtained by pulling the tape out of the trailer using two or three personnel or by connecting the tape to a vehicle. Ensure that the shuttle valve on the BAK-12 is in the OFF position for this operation. If a LWFB or Standard Fairlead beam is being installed with the MAAS, pull out the tape, reeve the beams, and install the tape connectors.



Attach the ends of the hook cable to the tape connectors.

Evenly space the support discs on 8- to 10-foot centers along the length of the barrier hook cable. Avoid placing a support disc at the centerline of the runway operating surface.

Confirm that all anchor plates are installed, tightened, and inspected on both trailers. Start the BAK-12 rewind engine, per normal operating procedures.

Pretension the hook cable, per normal operating procedures.

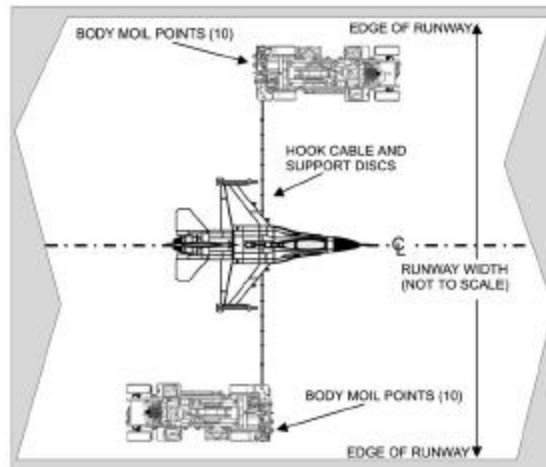
Shut down the BAK-12 rewind engine.

**MAAS on Asphalt (greater than 1 inch thick) Over Concrete:**

**CAUTION:** Installation of the MAAS using Moil Points on asphalt (thicker than 1 inch) over a concrete runway is **limited to a 40,000 pound aircraft at 150 knots. This installation method is not T.O. certified for heavy weight aircraft.** Prior to using this method, inspect the runway to determine that the asphalt layer is 6 inches or less in depth. The asphalt should not have alligator or embrittlement type (block) cracking such that the asphalt layers have failed. Asphalt greater than 6 inches in depth could prevent the moil point driving tip from embedding sufficiently in solid concrete.

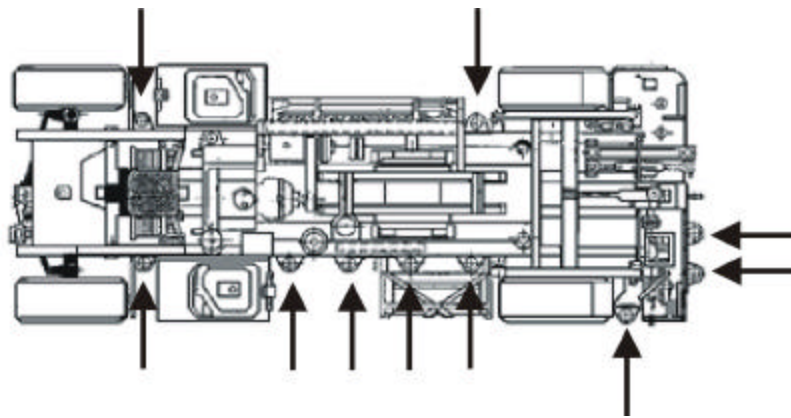
Installation of the MAAS on this type runway surface (figure 53) is accomplished by installing moil points into the ten stake pockets with bushings on each MAAS trailer.

**Figure 53. MAAS on Asphalt Over Concrete – Bi-directional (Limited Weight and Speed) Operation.**



The trailers are installed identically using only the ten stake pockets (figure 54).

**Figure 54. Moil Point Locations on the MAAS.**



There is no difference as to which direction the aircraft approach. Therefore, the installation is capable of **bi-directional engagements**.

At least a 4-person team, made up of two 2-person teams, is assigned to anchor each MAAS trailer. Each 2-person team is assigned to a hydraulic power unit (HPU) on one side of the trailer and proceeds to anchor the moil points on their side and/or the end of the trailer. Both trailers are installed using the same procedures.

**Basic Steps for Installation:**

With the trailers positioned and lowered, remove the required installation tools and hardware stored on each trailer.

After removing the cruciform stakes and storage bracket, install one moil point bushing in the empty stake pocket.

Connect the hydraulic breakers to the 50-foot hoses attached to the HPUs. Ensure that the quick disconnect fittings are clean before connecting.

Start the HPUs, per normal operating procedures.

Insert amoil point into the breaker and lock into place.

Insert themoil point through the bushing in the stake pocket and drive themoil point through the asphalt and into the concrete (figure 55).

**Figure 55. Moil Point Being Driven into the Pavement System.**

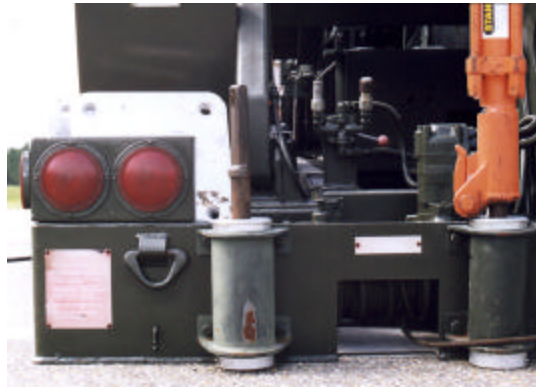


Stop driving when the bottom of the locking retaining spring of the breaker is just above the MAAS trailer body frame. For the new Stanley breaker, the bottom of the Stanley latching latch will just be touching themoil point bushing (figure 56). This will provide for the required clearance to allow removal of themoil points.

Unlock the Moil point from the breaker and repeat the above three steps for the nine remaining moil points.

When all 10 moil points have been installed, shut down the HPU, store the breakers and hose assemblies, move to the other trailer, and repeat the above steps.

**Figure 56. Proper Clearance and Moil Point in Position.**



**Basic Steps for Readyng the MAAS:**

While each MAAS trailer is being installed, unless personnel are required to assist in the installation of the trailers, remove the hook cable from its storage reel and drag it across the runway.

**NOTE:** If hook cables have been prepositioned at the base location and are to be used instead of the 90-foot and 153-foot hook cables supplied with the MAAS, then the prepositioned cable must be brought to the site, prepared for use (to include placing support discs on cable), and dragged across the runway.

Pull out enough slack in the tape system to enable the hook cable to be attached to the tape connectors. This slack may be obtained by pulling the tape out of the trailer using two or three personnel or by connecting the tape to a vehicle. Ensure that the shuttle valve on the BAK-12 is in the OFF position for this operation.

Attach the ends of the hook cable to the tape connectors.

Evenly space the support discs on 8- to 10-foot centers along the length of the barrier hook cable. Avoid placing a support disc at the centerline of the runway operating surface.

Confirm that all moil points on both trailers have been installed. Start the BAK-12 rewind engine, per normal operating procedures.

Pretension the hook cable, per normal operating procedures.

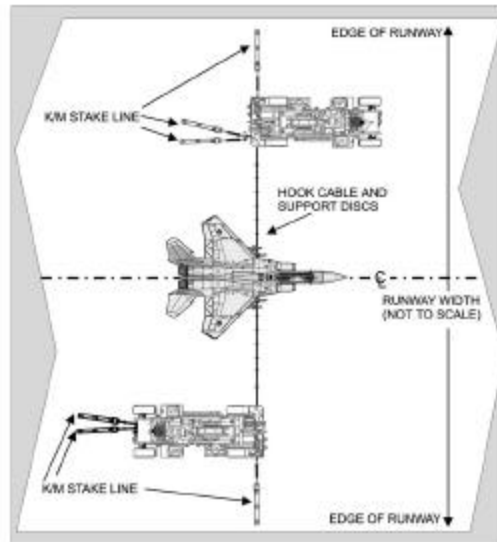
Shut down the BAK-12 rewind engine.

**MAAS on Asphalt With A Soil Base -- Unidirectional Operation:**

Installation of the MAAS on this type runway surface (figure 57) is accomplished by installing a KM Anchoring System. The anchor mechanism uses three KM stake lines in a 3-stake system, for a total of 9 stakes. Body stakes are not required for this installation due to the usually higher soil quality and compaction under the asphalt paving.

The stake lines are located at two different anchoring locations (figures 58, 59, and 60) on each MAAS. The locations are dependent on the approach direction of the aircraft. Note: The left rear anchor point may also be referred to as the pretension anchor point.

**Figure 57. MAAS on Asphalt Over Soil-- Unidirectional Operation.**



**Figure 58. Left Rear Anchor Point – Both MAAS Trailers** (trailer shown raised only for clarity).

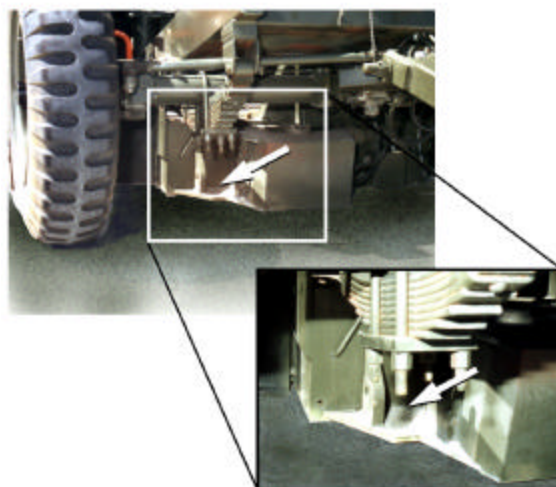


**Figure 59. Right Rear Anchor Point – Left MAAS Trailer.**



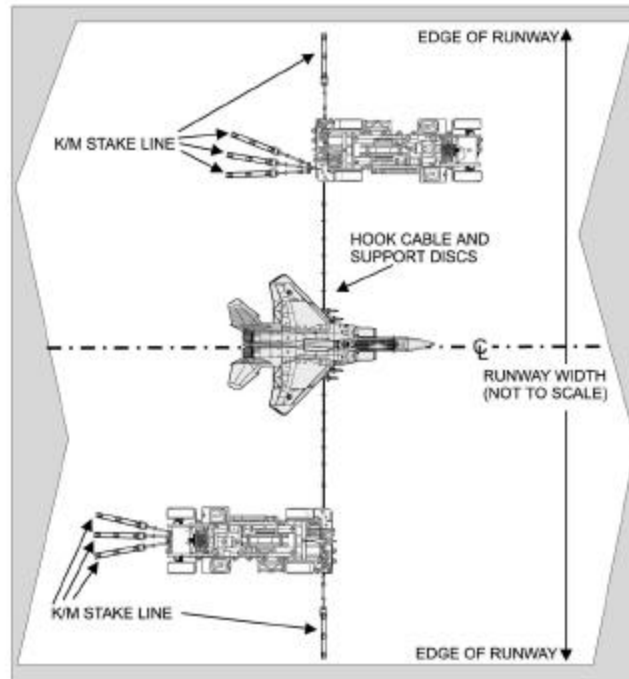


**Figure 60. Right Front Anchor Point – Right MAAS Trailer** (trailer shown raised only for clarity).



**NOTE:** If the MAAS is to be installed for higher loads, such as for a heavyweight aircraft unidirectional operation or for use as an abort end barrier (figure 61), then an additional 3-stake system (for a total of 12 stakes) is used. The additional 3-stake line is attached to the triple-turnbuckle fitting.

**Figure 61. MAAS on Asphalt Over Soil for Heavyweight or Abort End – Unidirectional Operation.**



At least a 4-person team, made up of two 2-person teams, is assigned to anchor each MAAS trailer. Each 2-person team is assigned to a hydraulic power unit (HPU) on one side of the trailer and proceeds to use digging chisels to remove asphalt from where anchors will be driven into the soil. Both trailers are installed using the same procedures.

**Basic Steps for Installation:**

With the trailers positioned and lowered, attach the triple-turnbuckle fitting to the appropriate anchor point with the 1 1/4-inch clevis pins and hitch clip pins.

Attach all the turnbuckles to the appropriate anchor point connections on the MAAS or the triple-turnbuckle fitting.

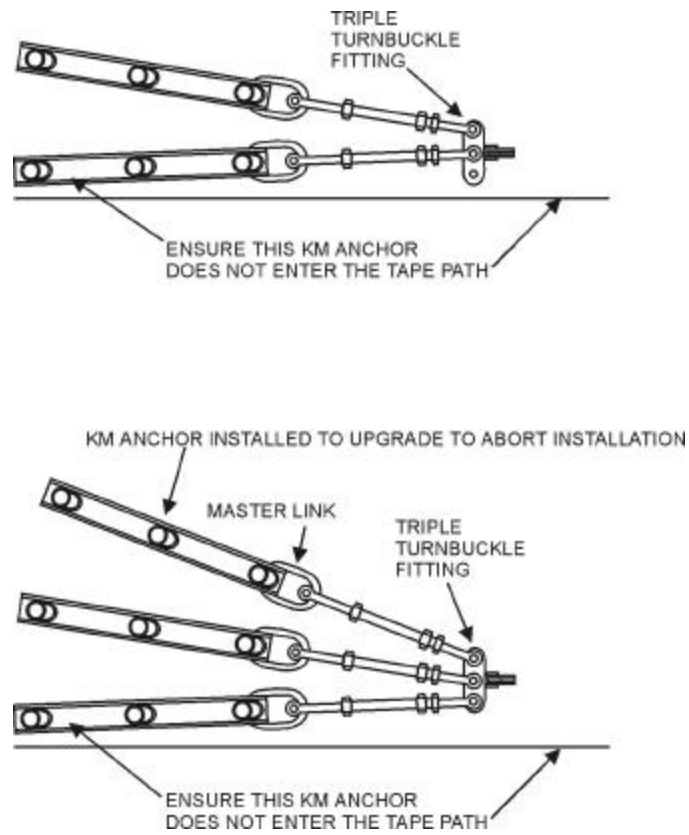
**NOTE:** When two turnbuckles are installed on the triple-turnbuckle fitting, the turnbuckle closest to the runway operating surface is attached to the middle position of the triple-turnbuckle fitting. The second turnbuckle is attached to the outside position (away from the runway operating surface) of the triple-turnbuckle fitting. When two or three (figure 62) turnbuckles are installed at the right rear or the right front end of the MAAS trailers, the turnbuckle with KM stake line which is closest to the runway operating surface is run almost parallel to the edge of the runway operating surface. It may be angled toward the runway operating surface as long as the 3-stake KM anchoring line does not extend into the tape sweep path. The other KM stake lines on the triple-turnbuckle fitting are spaced at approximately 15 inches between the first two stake guides.

Install the stake lines per normal procedures.

Perform a final tightening check on all the turnbuckles, but do not tighten enough to cause the trailer to move. Tighten the locknuts on each turnbuckle.

Repeat the above actions for the MAAS on the other side of the runway.

**Figure 62. Triple-Turnbuckle Fitting Upgraded from Two to Three KM Stake Lines.**



**Basic Steps for Readyng the MAAS:**

While each MAAS trailer is being installed, unless personnel are required to assist in the installation of the trailers, remove the hook cable from its storage reel and drag it across the runway.

**NOTE:** If hook cables have been prepositioned at the base location and are to be used instead of the 90-foot and 153-foot hook cables supplied with the MAAS, then the prepositioned cable must be brought to the site, prepared for use (to include placing support discs on cable), and dragged across the runway.

Pull out enough slack in the tape system to enable the hook cable to be attached to the tape connectors. This slack may be obtained by pulling the tape out of the trailer using two or three personnel or by connecting the tape to a vehicle. Ensure that the shuttle valve on the BAK-12 is in the OFF position for this operation. If a LWFB or Standard Fairlead beam are being installed with the MAAS, pull out the tape, reeve the beams, and install the tape connectors.

Attach the ends of the hook cable to the tape connectors.

Evenly space the support discs on 8- to 10-foot centers along the length of the barrier hook cable. Avoid placing a support disc at the centerline of the runway operating surface.

Confirm that all the KM outriggers have been installed and the turnbuckles and locknuts have been tightened. Start the BAK-12 rewind engine, per normal operating procedures.

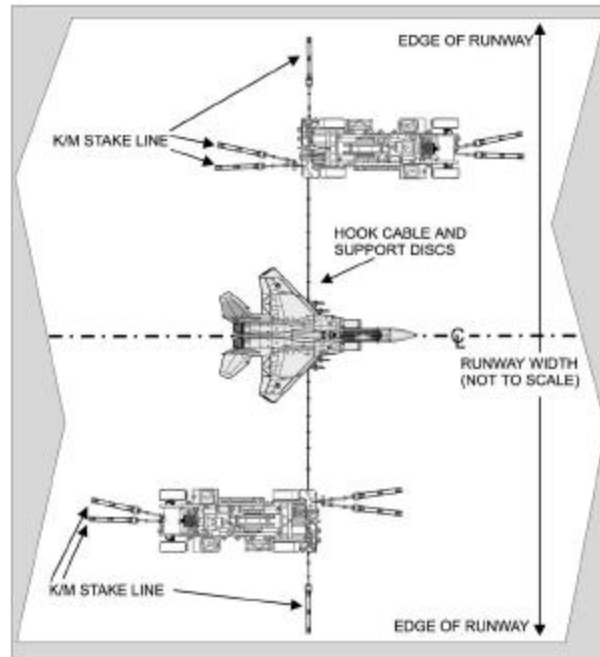
Pretension the hook cable, per normal operating procedures.

Shut down the BAK-12 rewind engine.

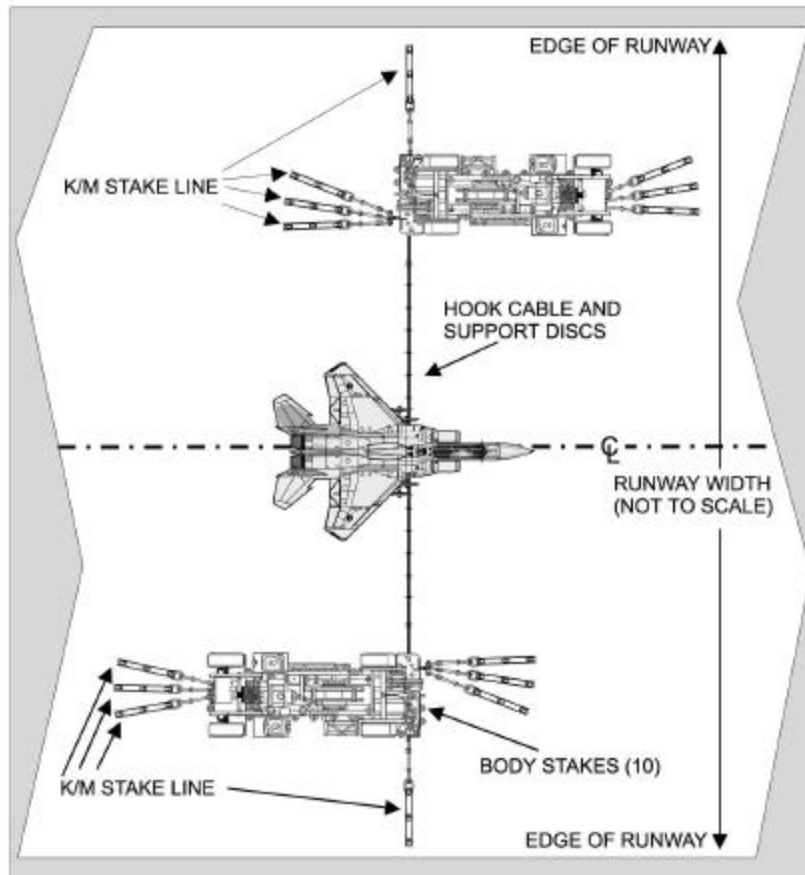
**MAAS on Asphalt With A Soil Base -- Bi-directional Operation:**

Installation of the MAAS on this type runway surface (figure 63) is accomplished by installing a KM Anchoring System. The anchor mechanism for bi-directional use is with KM stake lines; the anchors are increased from the normal setup for the heavyweight setup. The normal setup uses five KM stake lines in a 3-stake system (for a total of 15 stakes), while the heavyweight setup (figure 64) uses seven KM stake lines in a 3-stake system (for a total of 21 stakes).

**Figure 63. MAAS on Asphalt Over Soil – Bi-directional Operation.**



**Figure 64. MAAS on Asphalt Over Soil for Heavyweight, Bi-directional Operation.**



**NOTE:** The heavyweight configuration should be used for installation if the base will be supporting a mix of aircraft.

**GENERAL NOTE:** When a MAAS trailer has received the ETL 98-10 upgrade, it will have the Stanley stake driver, which is an integral unit and does not require the use of a drive shank and stake driver. Throughout the following instructions for installation of stakes in the KM stakes lines, when mention is made of using a hydraulic breaker with a drive shank and stake driver, an integral Stanley stake driver may be used in lieu of the a hydraulic breaker.

Body stakes are not required for this installation due to the usually higher soil quality and compaction under the asphalt paving. The stake lines are located at three anchoring locations on each MAAS (figures 65, 66, and 67). The locations are not dependent on the approach direction of the aircraft. Note: The left rear anchor point may also be referred to as the pretension anchor point.

**Figure 65. Left Rear Anchor Point – Both MAAS Trailers** (trailer shown raised only for clarity).

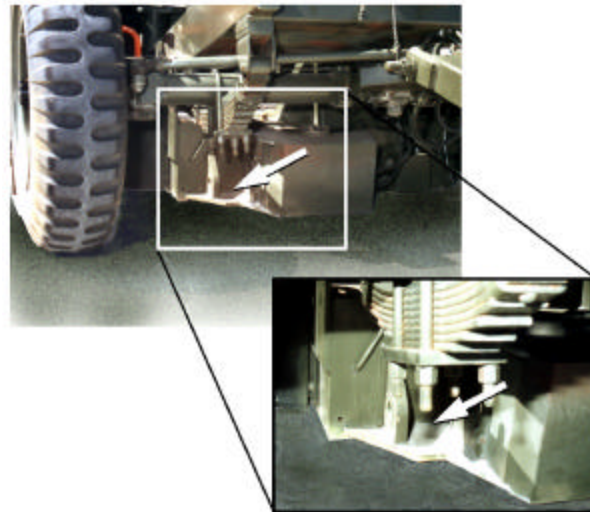




**Figure 66. Right Rear Anchor Point – Both MAAS Trailers.**



**Figure 67. Right Front Anchor Point – Both MAAS Trailers** (trailer shown raised only for clarity).



At least a 4-person team, made up of two 2-person teams, is assigned to anchor each MAAS trailer. Each 2-person team is assigned to a hydraulic power unit (HPU) on one side of the trailer and proceeds to use digging chisels to remove asphalt from where anchors will be driven into the soil. Both trailers are installed using the same procedures.

**Basic Steps for Installation:**

With the trailers positioned and lowered, attach the two triple-turnbuckle fitting to the appropriate anchor points with the 1 1/4-inch clevis pins and hitch clip pins.

Attach the five turnbuckles to the appropriate anchor point connections on the MAAS and the two triple-turnbuckle fittings. If installing for the heavyweight configuration, attach the seven turnbuckles that will be used for the connection.

**NOTE:** When two turnbuckles are installed on the triple-turnbuckle fitting, the turnbuckle closest to the runway operating surface is attached to the middle position of the triple-turnbuckle fitting. The second turnbuckle is attached to the outside position (away from the runway operating surface) of the triple-turnbuckle fitting. When two or three (figure 68) turnbuckles are installed at the right rear or the right front end of the MAAS trailers, the turnbuckle with KM stake line which is closest to the runway operating surface is run almost parallel to the edge of the runway operating surface. It may be angled toward the runway operating surface as long as the 3-stake KM anchoring line does not extend into the tape sweep path. The other KM stake lines on the triple-turnbuckle fitting are spaced at approximately 15 inches between the first two stake guides.

Install the stake lines following normal procedures.

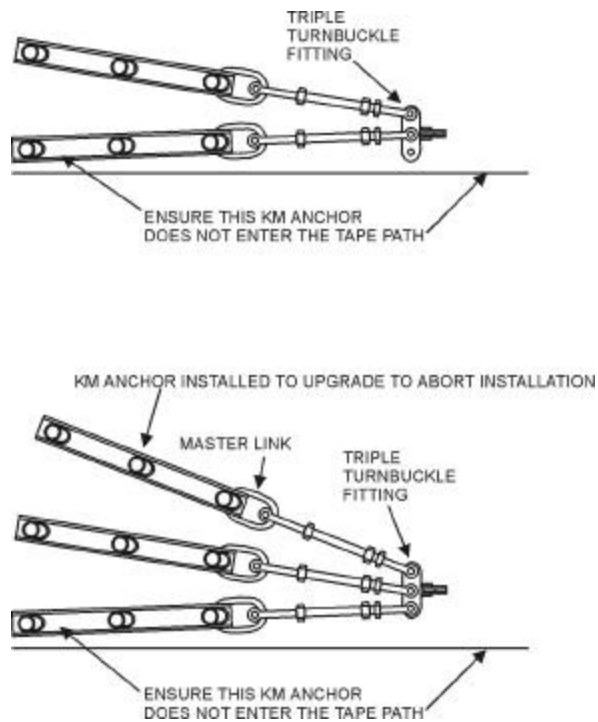
**NOTE:** The depth of asphalt to be removed may make it faster to have one team use the hydraulic breaker with a digging chisel to cut holes

through the asphalt while the other team uses the hydraulic breaker with a drive shank to drive the stakes.

When all stake lines are installed, perform a final check and tighten all the turnbuckles, but do not over-tighten them and cause the trailer to move. Tighten the locknuts on each turnbuckle.

Repeat the above actions for the MAAS on the other side of the runway.

**Figure 68. Triple-Turnbuckle Fitting Upgraded from Two to Three KM Stake Lines**



**Basic Steps for Readyng the MAAS:**

While each MAAS trailer is being installed, unless personnel are required to assist in the installation of the trailers, remove the hook cable from its storage reel and drag it across the runway.

**NOTE:** If hook cables have been prepositioned at the base location and are to be used instead of the 90-foot and 153-foot hook cables supplied with the MAAS, then the prepositioned cable must be brought to the site, prepared for use (to include placing support discs on cable), and dragged across the runway.

Pull out enough slack in the tape system to enable the hook cable to be attached to the tape connectors. This slack may be obtained by pulling the tape out of the trailer using two or three personnel or by connecting the tape to a vehicle. Ensure that the shuttle valve on the BAK-12 is in the OFF position for this operation.

Attach the ends of the hook cable to the tape connectors.

Evenly space the support discs on 8- to 10-foot centers along the length of the barrier hook cable. Avoid placing a support disc at the centerline of the runway operating surface.

Confirm that all the KM outriggers have been installed and the turnbuckles and locknuts have been tightened. Start the BAK-12 rewind engine, per normal operating procedures.

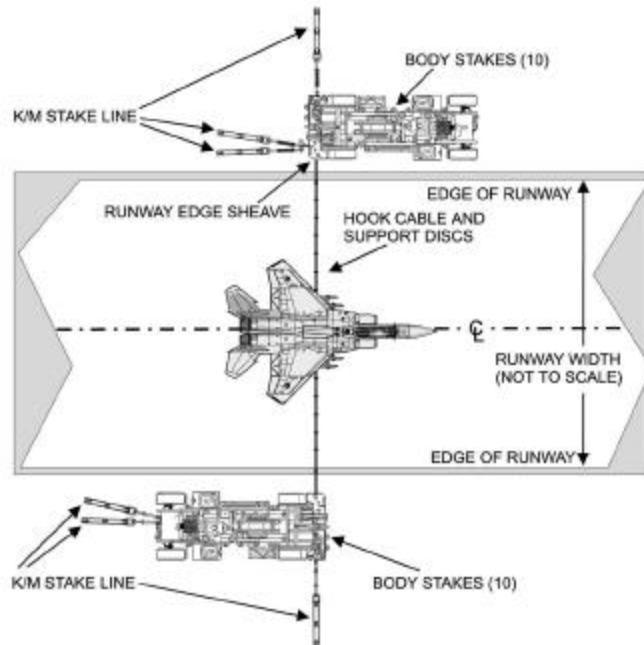
Pretension the hook cable, per normal operating procedures.

Shut down the BAK-12 rewind engine.

**MAAS on Soil -- Unidirectional Operation:**

Installation of the MAAS on this type of surface (figure 69) is accomplished by installing body stakes and a KM Anchoring System. The anchor mechanism uses body stakes at ten MAAS stake pockets and three KM stake lines in a 3-stake system, for a total of 19 stakes. Body stakes are required for this installation off the runway operating surface.

**Figure 69. MAAS on Soil – Unidirectional Installation.**



**GENERAL NOTE:** When a MAAS trailer has received the ETL 98-10 upgrade, it will have the Stanley stake driver, which is an integral unit and does not require the use of a drive shank and stake driver. Throughout the following instructions for installation of stakes in the KM stakes lines and/or in body stake holders, when mention is made of using a hydraulic breaker with a drive shank and stake driver, an integral Stanley stake driver may be used in lieu of the a hydraulic breaker.

The stake lines are located at two different anchoring locations on each MAAS (figures 70, 71, and 72). The locations are dependent on the approach direction of the aircraft. Note: The left rear anchor point may also be referred to as the pretension anchor point.

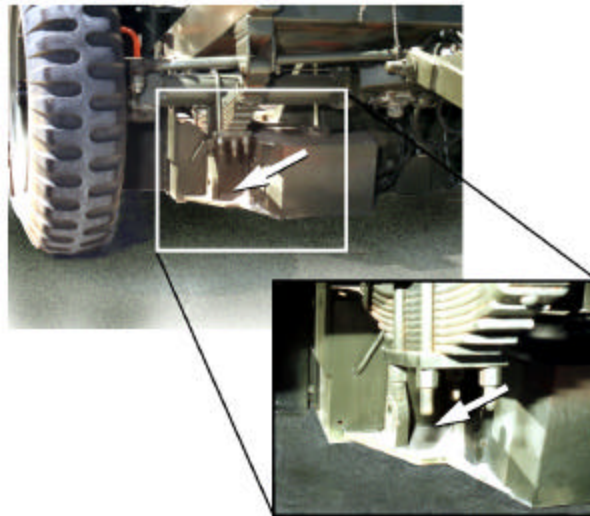
**Figure 70. Left Rear Anchor Point – Both MAAS Trailers** (trailer shown raised only for clarity).



**Figure 71. Right Rear Anchor Point – Left MAAS Trailer.**

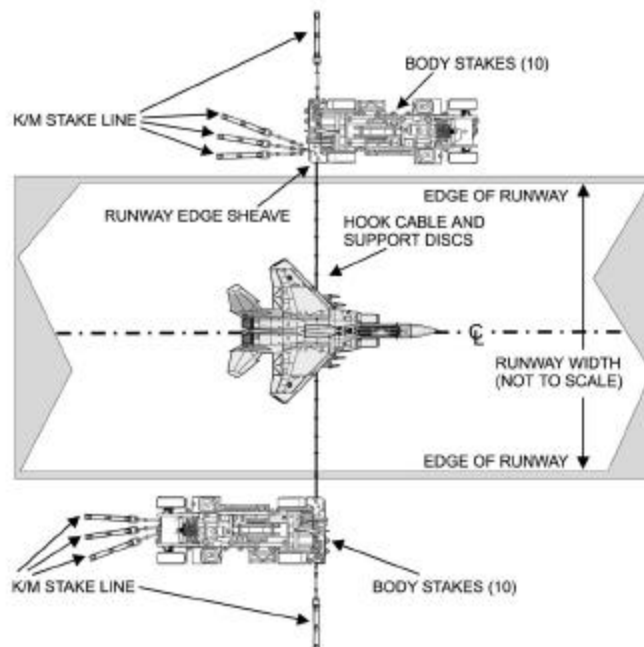


**Figure 72. Right Front Anchor Point – Right MAAS Trailer** (trailer shown raised only for clarity).



**NOTE:** If the MAAS is to be installed for higher loads, such as for a heavyweight aircraft unidirectional operation (figure 73) or for use as an abort end barrier, then an additional 3-stake system (for a total of 22 stakes) is used. The additional 3-stake line is attached to the triple-turnbuckle fitting.

**Figure 73. MAAS on Soil for Heavyweight, Unidirectional Operation.**





**CAUTION: If the installation of the MAAS is an emergency installation where time is critical,** it is limited to a 40,000-pound aircraft engaging at 150 knots. Install as a minimum four body stakes (two per side with one installed in/near each corner) to full depth and the 9 KM stake line stakes to a minimum of 36 inches depth. After the emergency, install all remaining stakes and drive to the correct depths. **There is no T.O. certified emergency installation for heavier weight fighter aircraft.**

At least a 4-person team, made up of two 2-person teams, is assigned to anchor each MAAS trailer. Each 2-person team is assigned to a hydraulic power unit (HPU) on one side of the trailer and proceeds to use hydraulic breakers to drive stakes into the soil. Both trailers are installed using the same procedures.

#### **Basic Steps for Installation:**

With the trailers positioned and lowered, connect the 50-foot hydraulic hose to the right side HPU and the quick disconnect block. Ensure that the quick disconnect fittings are clean before connecting. During lowering of the trailer, you should already have removed the rear stake storage bracket and the nine moil point bushings. Store the bushings in the equipment module storage box.

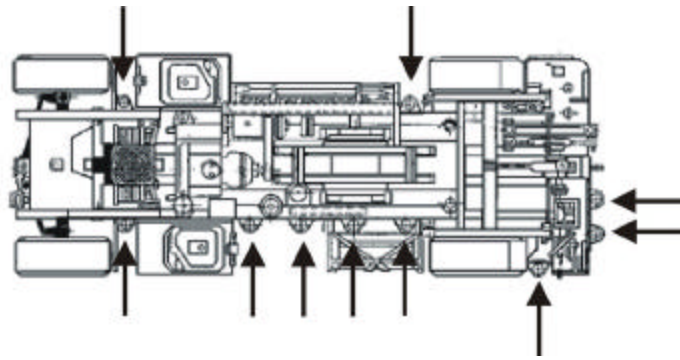
Start the right side HPU, per normal operating procedures. **Lower the rear wheels to the ground to facilitate installation of the body stakes.**

Install the 1 1/4-inch hex drive shank and the 3 1/2-inch stake driver on each hydraulic breaker unit. Install the hydraulic breakers on the hoses. Ensure that the quick disconnect fittings are clean before connecting.

Start the HPUs, per normal operating procedures.

Using the hydraulic breakers and the assembled work stands (if required), install the ten stakes in the stake pockets located along the outside of the trailer (figure 74).

**Figure 74. Stake Body Locations on the MAAS.**



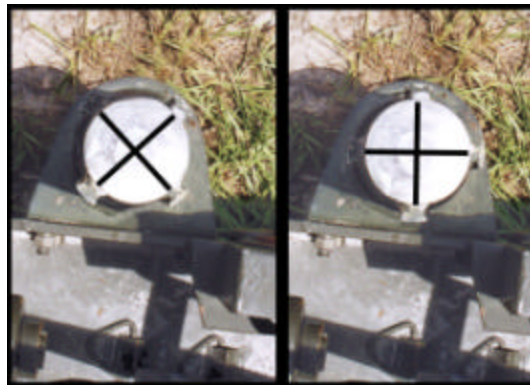
**General Instruction:** The stakes are painted green on the top 18 inches of stake. The stakes are driven into the soil until the painted portion of the stake reaches ground level (figure 75).

**Figure 75. Typical Body Stake Installation.**



Ensure that the stakes are oriented to allow stake removal. The stake pullers require different stake orientation, as shown for the current hydraulic ram stake puller (PHOTO ON THE LEFT) and the Stanley stake puller (PHOTO ON THE RIGHT) (figure 76).

**Figure 76. Proper Stake Orientation with the Body.**



After installation of the body stakes, reconnect the 50-foot hydraulic hose to the right side HPU. Again, raise the rear axle support frame/wheels to the MAAS's standard (installed) configuration, per normal operating procedures. Reconnect the hydraulic breaker to the 50-foot hoses attached to the HPU. Ensure that the quick disconnect fittings are clean before connecting.

Attach the triple-turnbuckle fitting to the appropriate anchor point (figures 77 and 78) with the 1 1/4-inch clevis pins and hitch clip pins.

**Figure 77. Triple-Turnbuckle Fitting on Right Rear Anchor Point – Left MAAS Trailer.**



**Figure 78. Triple-Turnbuckle Fitting on Right Front Anchor Point – Right MAAS Trailer.**



Attach the three turnbuckles to the appropriate anchor point connections on the MAAS and the triple-turnbuckle fitting. If installing for the heavyweight aircraft or abort end configuration, attach the four turnbuckles.

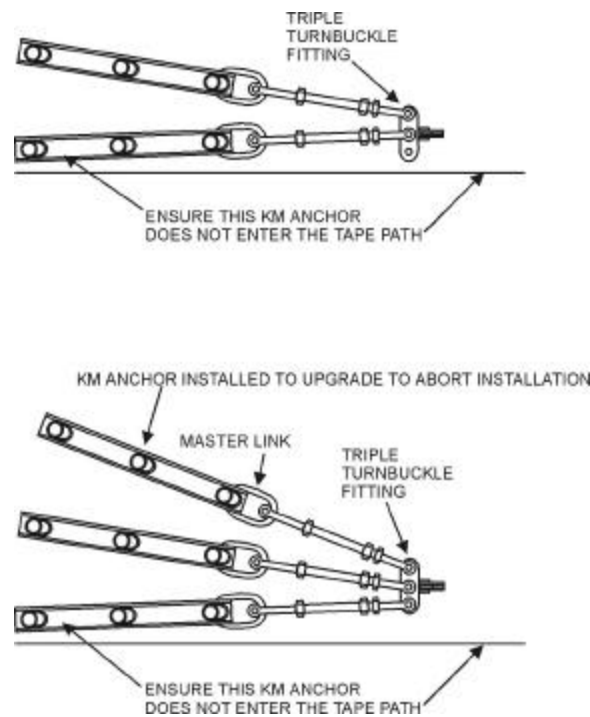
Install the stake lines per normal installation procedures.

**NOTE:** When two turnbuckles are installed on the triple-turnbuckle fitting, the turnbuckle closest to the runway operating surface is attached to the middle position of the triple-turnbuckle fitting. The second turnbuckle is attached to the outside position (away from the runway operating surface) of the triple-turnbuckle fitting. When two or three (figure 79) turnbuckle are installed at the right rear or the right front end of the MAAS trailers, the turnbuckle with KM stake line which is closest to the runway operating surface is run almost parallel to the edge of the runway operating surface. It may be angled toward the runway operating surface as long as the 3-stake KM anchoring line does not extend into the tape sweep path. The other KM stake lines on the triple-turnbuckle fitting are spaced at approximately 15 inches between the first two stake guides.

After installing the stake lines, perform a final tightening check on all the turnbuckles and tighten the locknuts on each turnbuckle.

Repeat the above actions for the MAAS on the other side of the runway.

**Figure 79. Triple-Turnbuckle Fitting Upgraded from Two to Three KM Stake Lines.**



**Basic Steps for Readyng the MAAS:**

While each MAAS trailer is being installed, unless personnel are required to assist in the installation of the trailers, remove the hook cable from its storage reel and drag it across the runway.

**NOTE:** If hook cables have been prepositioned at the base location and are to be used instead of the 90-foot and 153-foot hook cables supplied with the MAAS, then the prepositioned cable must be brought to the site, prepared for use (to include placing support discs on cable), and dragged across the runway.

Pull out enough slack in the tape system to enable the hook cable to be attached to the tape connectors. This slack may be obtained by pulling the tape out of the trailer using two or three personnel or by connecting the tape to a vehicle. Ensure that the shuttle valve on the BAK-12 is in the OFF position for this operation. If a LWFB or Standard Fairlead beam is being installed with the MAAS, pull out the tape, reeve the beams, and install the tape connectors.

Attach the ends of the hook cable to the tape connectors.

Evenly space the support discs on 8- to 10-foot centers along the length of the barrier hook cable. Avoid placing a support disc at the centerline of the runway operating surface.

Confirm that all body stakes have been installed in the body stake pockets and that the KM outriggers have been installed and the turnbuckles and locknuts have been tightened.

Start the BAK-12 rewind engine, per normal operating procedures.

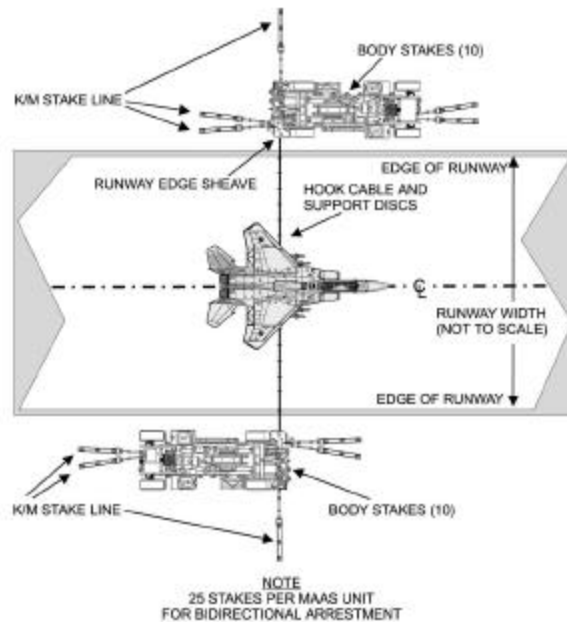
Pretension the hook cable, per normal operating procedures.

Shut down the BAK-12 rewind engine.

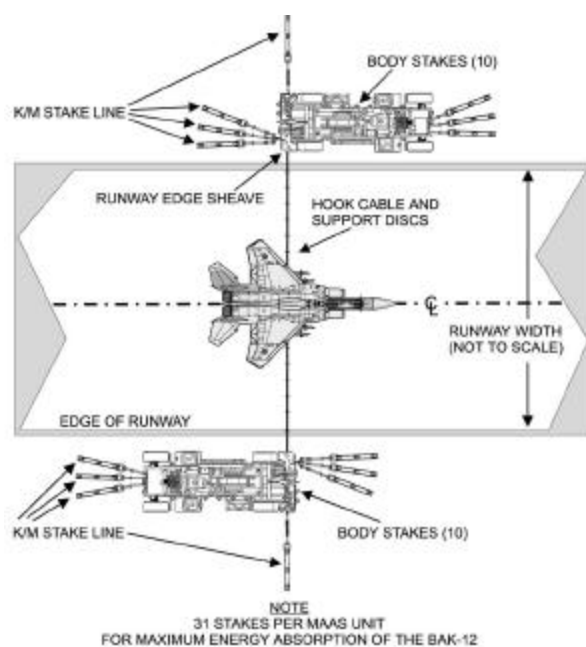
**MAAS on Soil -- Bi-directional Operation:**

Installation of the MAAS on this type of surface (figure 80) is accomplished by installing body stakes and a KM Anchoring System. Body stakes are required for this installation off the runway operating surface. The normal weight setup anchor mechanism uses body stakes at ten MAAS stake pockets and five KM stake lines in a 3-stake system, for a total of 25 stakes. A heavyweight setup (figure 81) uses an additional two KM stake lines (for a total of 31 stakes).

**Figure 80. MAAS on Soil – Bi-directional Operation.**





**Figure 81. MAAS on Soil for Heavyweight, Bi-directional Operation.**

The stake lines are located at three anchoring locations (figures 82, 83, and 84) on each MAAS. The locations are not dependent on the approach direction of the aircraft. Note: The left rear anchor point may also be referred to as the pretension anchor point.

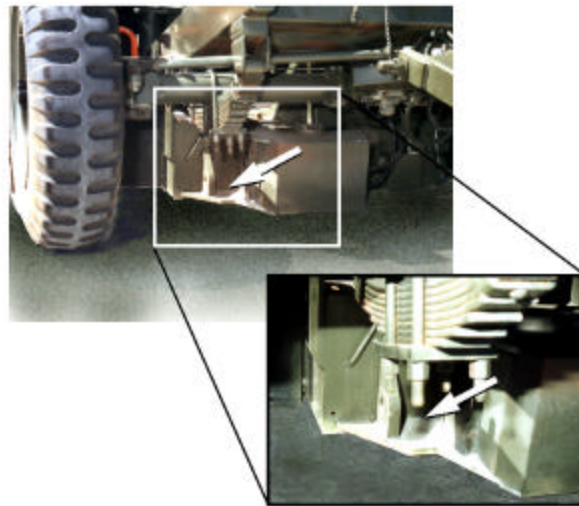
**Figure 82. Left Rear Anchor Point – Both MAAS Trailers** (trailer shown raised only for clarity).



**Figure 83. Right Rear Anchor Point – Both MAAS Trailers.**



**Figure 84. Right Front Anchor Point – Both MAAS Trailers** (trailer shown raised only for clarity).



**CAUTION:** If the installation of the MAAS is an emergency installation where time is critical, it is limited to a 40,000-pound aircraft engaging at 150 knots. Install as a minimum four body stakes (two per side with one installed in/near each corner) to full depth and the 15 KM stake line stakes to a minimum of 36 inches depth. After the emergency, install all remaining stakes and drive to the correct depths. **There is no T.O. certified emergency installation for heavier weight fighter aircraft.**

At least a 4-person team, made up of two 2-person teams, is assigned to anchor each MAAS trailer. Each 2-person team is assigned to a hydraulic power unit (HPU) on one side of the trailer and proceeds to use hydraulic

breakers to drive stakes into the soil. Both trailers are installed using the same procedures.

**GENERAL NOTE:** When a MAAS trailer has received the ETL 98-10 upgrade, it will have the Stanley stake driver, which is an integral unit and does not require the use of a drive shank and stake driver. Throughout the following instructions for installation of stakes in the KM stakes lines and/or in body stake holders, when mention is made of using a hydraulic breaker with a drive shank and stake driver, an integral Stanley stake driver may be used in lieu of the a hydraulic breaker.

**Basic Steps for Installation:**

With the trailers positioned and lowered, remove the required installation tools, hardware, and the work stands stored on each trailer. During lowering of the trailer, you should already have removed the rear stake storage bracket and the ninemoil point bushings. Store the bushings in the equipment module storage box.

Connect the 50-foot hydraulic hose to the right side HPU and the quick disconnect block. Ensure that the quick disconnect fittings are clean before connecting.

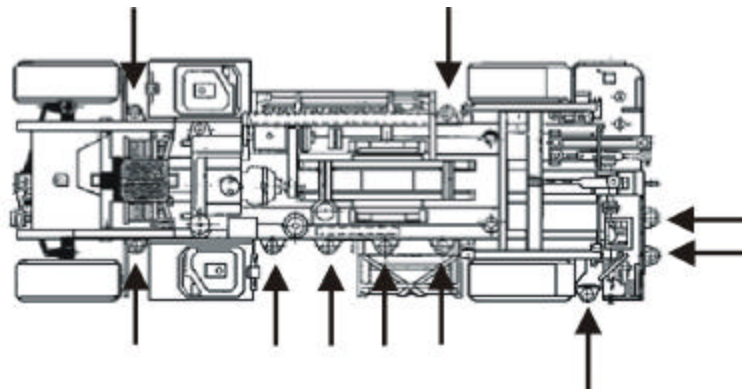
Start the right side HPU, per normal operating procedures. Lower the rear wheels to the ground to facilitate installation of the body stakes.

Install the 1 1/4-inch hex drive shank and the 3 1/2-inch stake driver on each hydraulic breaker unit.

Connect the hydraulic breakers to the 50-foot hoses attached to the HPUs. Ensure that the quick disconnect fittings are clean before connecting. Start the HPUs, per normal operating procedures.

Using the hydraulic breakers and assembled work stands (if required), install the ten stakes in the stake pockets (figure 85) located along the outside of the trailer.

**Figure 85. Stake Body Locations on the MAAS.**



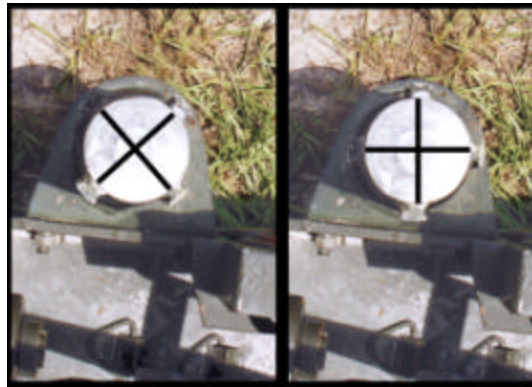
**General Instruction:** The stakes are painted green on the top 18 inches of stake. The stakes are driven into the soil until the painted portion of the stake reaches ground level (figure 86).

**Figure 86. Typical Body Stake Installation.**



Ensure that the stakes are oriented to allow stake removal. The stake pullers require different stake orientation, as shown for the current hydraulic ram stake puller (PHOTO ON THE LEFT) and the Stanley stake puller (PHOTO ON THE RIGHT) (figure 87).

**Figure 87. Proper Stake Orientation with the Body.**



After installation of the body stakes, reconnect the right side HPU to the MAAS trailer. Again, raise the rear axle support frame/wheels to the MAAS's standard (installed) configuration, per normal operating procedures.

Reconnect the hydraulic breaker with drive shank to the 50-foot hoses attached to the right side HPU. Ensure that the quick disconnect fittings are clean before connecting.

Attach the triple-turnbuckle fittings to the appropriate anchor points (figures 88 and 89) with the 1 1/4-inch clevis pins and hitch clip pins.

**Figure 88. Triple-Turnbuckle Fitting on Right Rear Anchor Point – Both MAAS Trailers.**



**Figure 89. Triple-Turnbuckle Fitting on Right Front Anchor Point – Both MAAS Trailers.**



Attach the five turnbuckles to the appropriate anchor point connections on the MAAS and the triple-turnbuckle fittings. If installing for the heavyweight configuration, install the seven turnbuckles.

Install the stake lines per normal procedures.

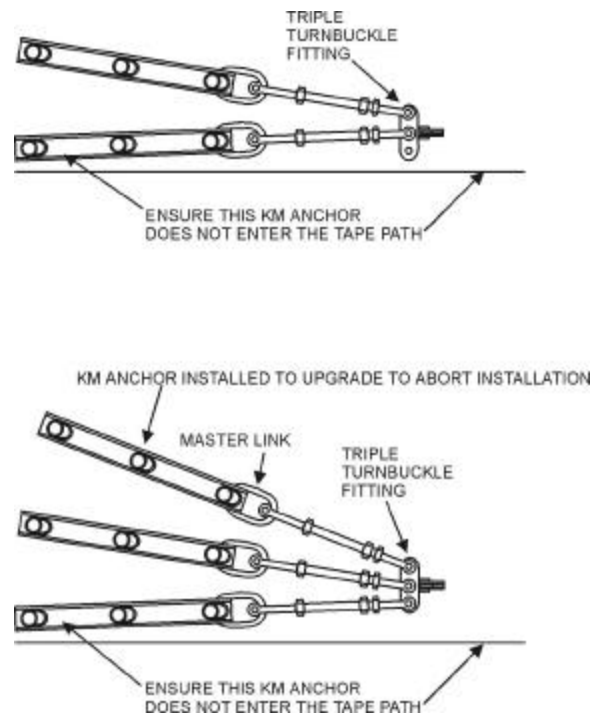
**NOTE:** When two turnbuckles are installed on the triple-turnbuckle fitting, the turnbuckle closest to the runway operating surface is attached to the middle position of the triple-turnbuckle fitting and the second turnbuckle is attached to the outside position (away from the runway operating surface) of the triple-turnbuckle fitting. When two or three (figure 90) turnbuckles are installed at the right rear or the right front end of the MAAS trailers, the turnbuckle with KM stake line which is closest to the runway operating surface is run almost parallel to the edge of the runway operating surface. It may be angled toward the runway operating surface as long as the 3-stake KM anchoring line does not extend into the tape sweep path. The other KM stake lines on the triple-turnbuckle fitting are spaced at approximately 15 inches between the first two stake guides.

After installing all the stake lines, perform a final tightening check on all the turnbuckles and tighten the locknuts on each turnbuckle.

Repeat the above actions for the MAAS on the other side of the runway.



**Figure 90. Triple-Turnbuckle Fitting Upgraded from Two to Three KM Stake Lines.**



**Basic Steps for Readyng the MAAS:**

While each MAAS trailer is being installed, unless personnel are required to assist in the installation of the trailers, remove the hook cable from its storage reel and drag it across the runway.

**NOTE:** If hook cables have been prepositioned at the base location and are to be used instead of the 90-foot and 153-foot hook cables supplied with the MAAS, then the prepositioned cable must be brought to the site, prepared for use (to include placing support discs on cable), and dragged across the runway.

Pull out enough slack in the tape system to enable the hook cable to be attached to the tape connectors. This slack may be obtained by pulling the tape out of the trailer using two or three personnel or by connecting the tape to a vehicle. Ensure that the shuttle valve on the BAK-12 is in the OFF position for this operation. If a LWFB or Standard Fairlead beam is being installed with the MAAS, pull out the tape, reeve the beams, and install the tape connectors.

Attach the ends of the hook cable to the tape connectors.

Evenly space the support discs on 8- to 10-foot centers along the length of the barrier hook cable. Avoid placing a support disc at the centerline of the runway operating surface.

Confirm that all the KM outriggers have been installed and the turnbuckles and locknuts have been tightened. Start the BAK-12 rewind engine, per normal operating procedures.

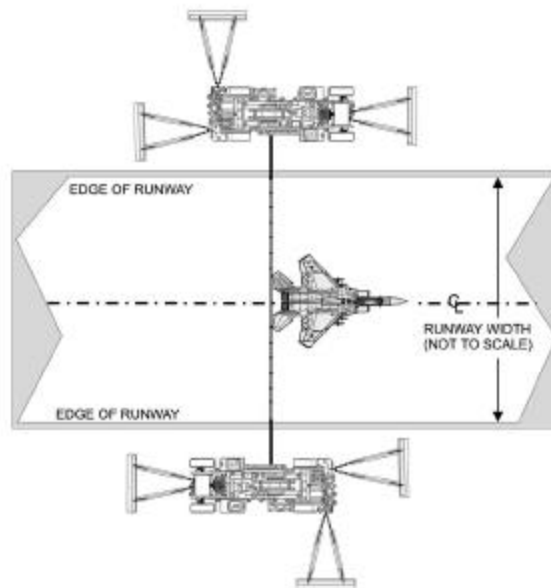
Pretension the hook cable, per normal operating procedures.

Shut down the BAK-12 rewind engine.

**MAAS on A Low Bearing Pressure Soil (CBR Less Than 7):**

Installation of the MAAS on this type of surface with a very low bearing pressure (figure 91) is accomplished by installing three sets of deadman anchors and 10 body stakes.

**Figure 91. MAAS with Deadman Anchors (Low CBR Soil).**



Both trailers are installed using the same procedures for the three anchoring locations (figures 92, 93, and 94) on each MAAS. Note: The left rear anchor point may also be referred to as the pretension anchor point.

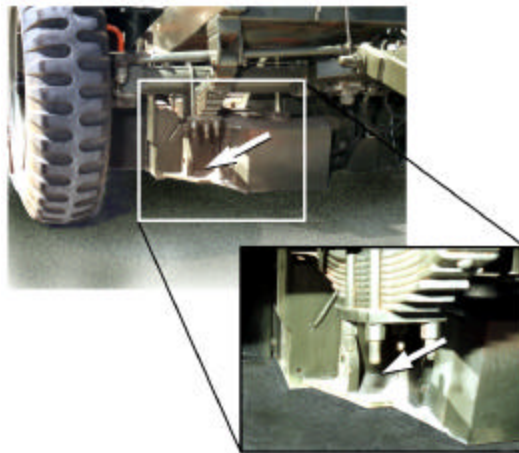
**Figure 92. Left Rear Anchor Point – Both MAAS Trailers** (trailer shown raised only for clarity).



**Figure 93. Right Rear Anchor Point – Both MAAS Trailers.**



**Figure 94. Right Front Anchor Point – Both MAAS Trailers** (trailer shown raised only for clarity).



This installation can support bi-directional, heavier weight fighter aircraft operations. The anchoring locations are not dependent on the approach direction of the aircraft. More than the regular six-person team will be required for digging, filling and compacting trenches associated with the installation of the deadman anchors. This installation requires support of heavy equipment and operators.

Obtaining and fabricating metal deadman and backer plates will be required ahead of the installation. When planning a deployment to a location which has low bearing pressure soil, the deadman chain assembly anchors must be considered early on in the process. The requirement consists of:

- 6 each of P/N 152-A-1396-1 Chain Assembly Anchors,
- 3 each of the triple-turnbuckle fittings,
- 6 each of the triple turnbuckles,

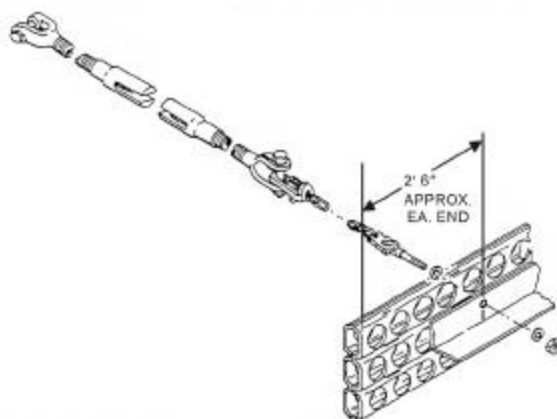
3 each 6 inch x 6 inch x 3/8 inch by 12 foot steel angle backing plates, and either

6-12 foot PSP or 3-12 foot AM2 matting sheets.

1-Trailer adapter fitting, complete (1 each of parts 52D10259-1, G-4065—1 1/2, and 52D7800-20) [See Attachment 2]

The materials should be obtained and/or fabricated (figure 95) prior to deployment when rapid installation is required. See T.O. 35E8-2-5-1 for instruction on fabricating the dead-man anchor assemblies.

**Figure 95. Typical Fabrication of Chain and Deadman.**

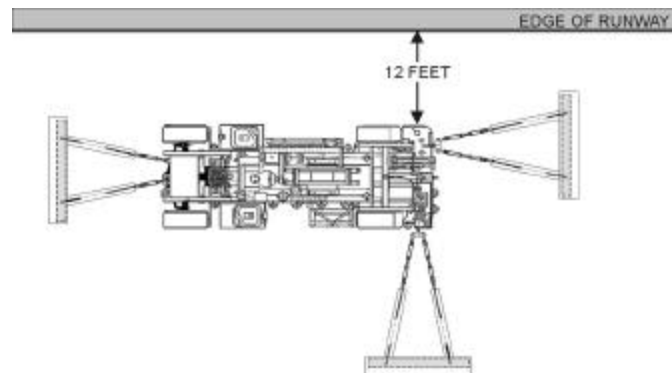


The installation steps outlined below do not detail the construction of the deadman anchors. Since the MAAS units use deadman anchors, the set point Distances B-A and C-A are nearly the same as would be required for the installation of a Fairlead beam using deadman anchors.

$$\text{Distance (B-A)} = \frac{\text{Runway Width}}{2} + \text{RRS} = \text{Distance (C-A)},$$

which is dependent on the width of the runway and the required runway setback (RRS). For a MAAS, the typical setback from the runway can be taken as a minimum of 12 feet (figure 96). This should allow a sufficient distance from the runway for excavation while protecting the runway base materials from being disturbed, thus weakening the pavement structure. This distance may be increased if initial excavation shows a problem with soil instability near the runway.

**Figure 96. Setback and Detailed Layout.**



**Basic Steps for Installation:**

Position the trailers for the required runway setback and barrier hook cable location. Mark on the ground the locations where the three anchor points will fall at the right front, left rear, and right rear MAAS anchor points.

Depending on the equipment available and the soil conditions, the heavy equipment operators may be able to work with the MAAS unit in place. If they are not able to excavate with the trailer in place, then move the trailer to a distance safely out of the way of the heavy equipment operations. A backhoe, roller-compactor, compactor plates, shovels,

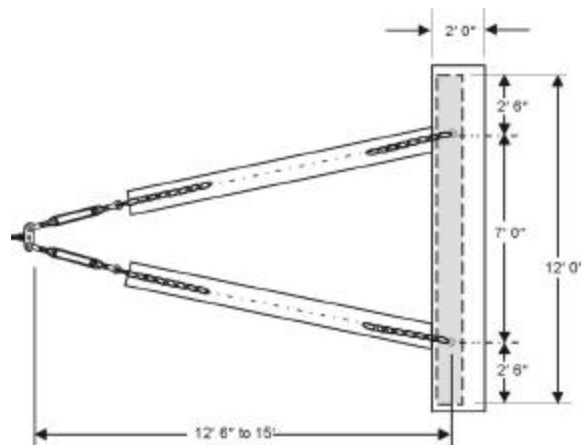
and/or excavator could be used for the installation of the deadman anchors.

Verify the length of the deadman anchor chains as laid out to ensure that the exact dimension are known. Anchor chains, triple-turnbuckle fitting, turnbuckles, and plate attachment hardware should measure out to between 12 feet 6 inches and 15 feet. Normally the component lengths should not exceed 15 feet.

**NOTE:** The locknut ends of the turnbuckles are to be toward the MAAS trailer.

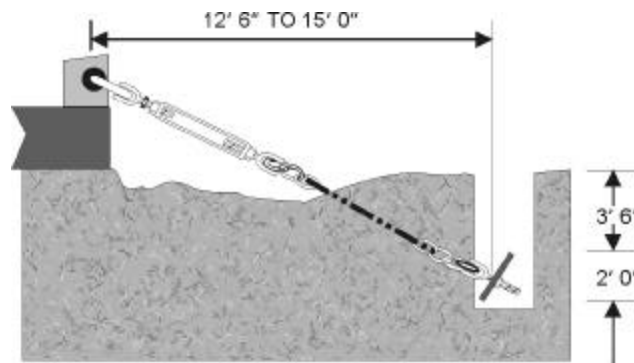
Based on the anchor point locations and the measured dimensions, lay out the locations for the trenches (figures 97 and 98). Dig the trenches, starting with the chain anchor trenches to avoid caving in the larger deadman trench. Ensure that the deadman trench has a vertical front face and has at least 3 feet 6 inches of cover above the top of the deadman.

**Figure 97. Typical Deadman, Chain, and Trench Layout – Plan View.**





**Figure 98. Typical Deadman, Chain, and Trench Layout – Elevation View.**



**Installing the Deadman Anchors:**

Adjust the six turnbuckles that will be used for the connection so that there is approximately 39 inches between the centers of the two clevis pins.

**NOTE:** A trailer adapter fitting must first be installed on the left rear anchor point, also referred to as the pretension anchor point, before a triple-turnbuckle fitting can be installed for this installation method. Install the trailer adapter fitting to the anchor point.

***If the MAAS trailer was left in place during the excavation, then:***

Lower the trailer per previously described procedures.

Attach the turnbuckles to the triple-turnbuckle fittings and attach the fittings to the MAAS anchor points.

Connect each of the deadman anchors to the anchor chain assembly and lower the deadman anchors into the trenches per the positions shown on the previous figure.

Fill the deadman trench first to a depth of 6 inches over the deadman. Compact the soil.

Continue to fill the deadman trench in using 6 inch lifts and compact each lift.

Pretension each anchor enough to stretch the chains out, but do not allow the trailer to move. Ensure that the chains do not rotate and possibly loosen the nuts on the anchor plates.

Repeat the above process of filling in and compacting the anchor chain trenches up to the turnbuckles.

Compact and level the trenches.

***If the MAAS trailer had to be moved during excavation, then:***

Connect each of the deadman anchors to the anchor chain assembly and lower the deadman anchors into the trenches per the positions shown on previous figure. Brace the deadman in position.

Fill the deadman trench first to a depth of 6 inches over the deadman. Compact the soil.

Continue to fill the deadman trench in using 6 inch lifts and compact each lift.

Pull the anchor chains taut.

Repeat the above process of filling in and compacting the anchor chain trenches up to the turnbuckles.

Compact and level the trenches.

Move the trailer back to the proper location and lower the trailer per previously described procedures.

Attach triple-turnbuckle fittings to the MAAS anchor points and attach the turnbuckles with the anchor chains.

Pretension each set of turnbuckles evenly on each triple turnbuckle fitting. Ensure that the chains do not rotate and possibly loosen the nuts on the anchor plates.

Recompact the soil in the trenches, as the chains will have slightly shifted and loosened the soil.

**Installing the body stakes:**

With the trailer anchored, remove the required installation tools, hardware, and the work stands stored on the trailer. During lowering of the trailer, you should already have removed the rear stake storage bracket and the nine moil point bushings. Store the bushings in the equipment module storage box.

**GENERAL NOTE:** When a MAAS trailer has received the ETL 98-10 upgrade, it will have the Stanley stake driver, which is an integral unit and does not require the use of a drive shank and stake driver. Throughout the following instructions for installation of stakes in the KM stakes lines and/or in body stake holders, when mention is made of using a hydraulic breaker with a drive shank and stake driver, an integral Stanley stake driver may be used in lieu of the a hydraulic breaker.

Connect the 50-foot hydraulic hose to the right side HPU and the quick disconnect block. Ensure that the quick disconnect fittings are clean before connecting.

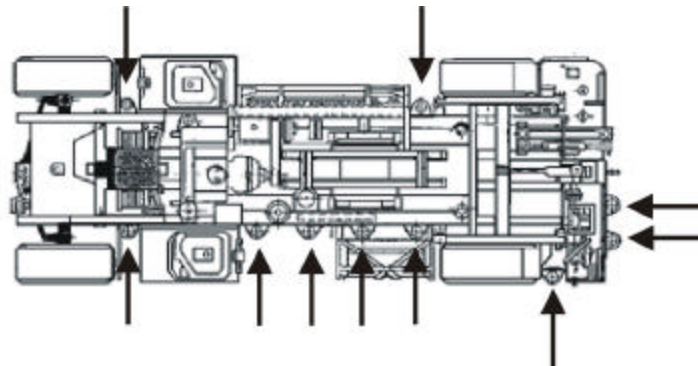
Start the right side HPU, per normal operating procedures. Lower the rear wheels to the ground to facilitate installation of the body stakes.

Install the 1 1/4-inch hex drive shank and the 3 1/2-inch stake driver on each hydraulic breaker unit.

Connect the hydraulic breakers to the 50-foot hoses attached to the HPUs. Ensure that the quick disconnect fittings are clean before connecting.

Place the ten stakes in the stake pockets (figure 99) located along the outside of the trailer and drive them into place with the hydraulic breakers.

**Figure 99. Stake Body Locations on the MAAS.**



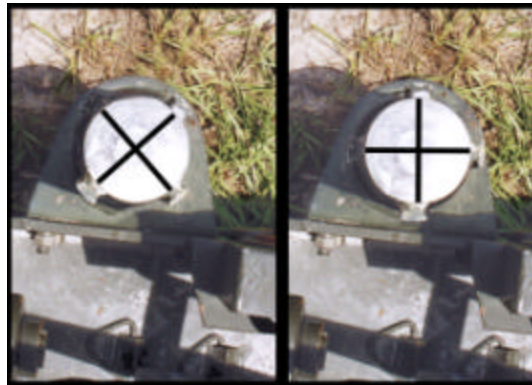
**General Instruction:** The stakes are painted green on the top 18 inches of stake. Drive the stake into the soil until the painted portion of the stake reaches ground level (figure 100) and ensure that the stakes are oriented to allow stake removal. The stake pullers require different stake orientation, as shown for the current hydraulic ram stake puller

(PHOTO ON THE LEFT) and the Stanley stake puller (PHOTO ON THE RIGHT) (figure 101).

**Figure 100. Typical Body Stake Installation.**



**Figure 101. Proper Stake Orientation with the Body.**



After installing the body stakes, shut down the right side HPU, reconnect to the MAAS trailer. Again, raise the rear axle support frame/wheels to the MAAS's standard (installed) configuration, per normal operating procedures.

Disconnect the hydraulic hose from the right side HPU and shut down the unit.

Perform a final tightening check on all the turnbuckles and tighten the locknuts on each turnbuckle.

Store all installation tools upon completion.

Repeat the above actions for the MAAS on the other side of the runway.

#### **Basic Steps for Readyng the MAAS:**

While each MAAS trailer is being installed, unless personnel are required to assist in the installation of the trailers, remove the hook cable from its storage reel and drag it across the runway.

**NOTE:** If hook cables have been prepositioned at the base location and are to be used instead of the 90-foot and 153-foot hook cables supplied with the MAAS, then the prepositioned cable must be brought to the site, prepared for use (to include placing support discs on cable), and dragged across the runway.

Pull out enough slack in the tape system to enable the hook cable to be attached to the tape connectors. This slack may be obtained by pulling the tape out of the trailer using two or three personnel or by connecting the tape to a vehicle. Ensure that the shuttle valve on the BAK-12 is in the OFF position for this operation. If a LWFB or Standard Fairlead beam are being installed with the MAAS, pull out the tape, reeve the beams, and install the tape connectors.

Attach the ends of the hook cable to the tape connectors.

Evenly space the support discs on 8- to 10-foot centers along the length of the barrier hook cable. Avoid placing a support disc at the centerline of the runway operating surface.

Confirm that all body stakes have been driven and the deadman anchor turnbuckles and the locknuts have been tightened. Start the BAK-12 rewind engine, per normal operating procedures.

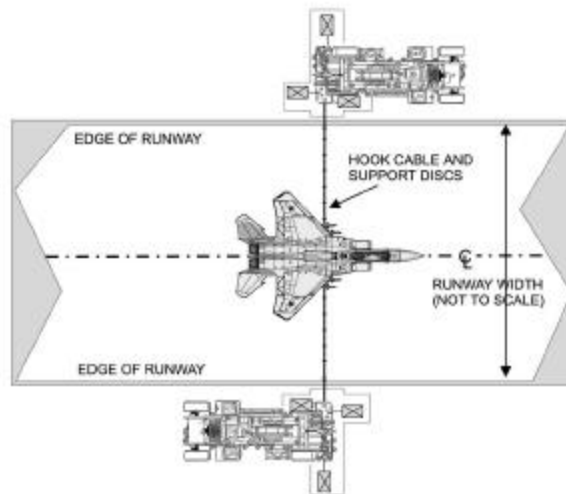
Tension the hook cable, per normal operating procedures.

Shut down the BAK-12 rewind engine.

**MAAS on Permafrost:**

Installation of the MAAS in arctic climate conditions where permafrost conditions exist (figure 102) requires that special, full depth concrete cruciform foundations be constructed. The foundations have sufficient mass, depth, and bearing surface to remain stable during freeze/thaw conditions and to withstand the forces of the aircraft engagement. The two cruciform foundations are located opposite of each other per operational requirements. This installation method can support heavier weight fighter aircraft operations and is capable of bi-directional operations.

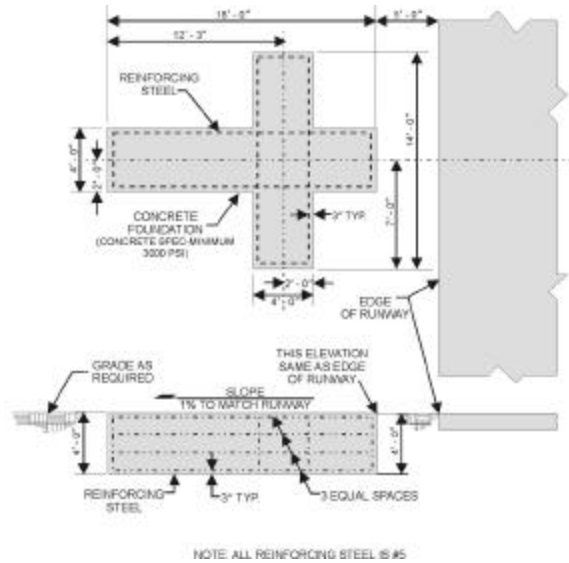
**Figure 102. MAAS on Cruciform Platform for Permafrost – Bi-directional Operation.**





The foundation system is reinforced concrete in a cruciform shape (figure 103). When constructed as shown, the concrete foundation rebar should not interfere with the installation of anchor bolts. Locate and adjust the plate locations to keep the edge of the plates at least 4 inches from the edge of the cruciform platforms to avoid interference while drilling the bolt holes.

**Figure 103. Concrete Cruciform Foundation Details.**



Installation of the MAAS is accomplished by installing three sets of concrete anchor plates to the concrete cruciform foundation and attaching the plates to the MAAS with turnbuckles. The anchor mechanism is with 1-inch diameter anchor bolts with a tapered nut. The additional Concrete Installation Kit for bi-directional operation is being added to the MAAS as a part of the MAAS upgrade. Ensure that the kits are available for installation; if not available with the deployed system, then kits must be ordered ahead of time.

**NOTE:** For stability on the platform, a three plate anchoring system is used, which also allows bi-directional operations. The right rear tire of each MAAS must be removed prior to installing the anchor plate. This is due to the anchor plate being located in the area under and near the right wheel assembly (figure 104).

**Figure 104. Anchor Plate Connection at Right Rear Wheel.**



At least two people should always work on and remove the wheel, which weighs 410 pounds. Rethread the lug nuts on the wheel studs after the wheel is removed. The barrier and installation personnel should work together to remove the wheel. Store the tire at the side of the MAAS away from the

runway and rethread the lug nuts on the wheel studs. The locations are not dependent on the approach direction of the aircraft. Both trailers are installed using the same procedures

At least a 4-person team, made up of two 2-person teams, is assigned to anchor each MAAS trailer. Each 2-person team is assigned to a hydraulic power unit (HPU) on one side of the trailer and proceeds to anchor the anchoring plate(s) on their side of the trailer with anchor bolts. Since there are three plates involved in this installation, one 2-person team will complete the installation of one plate and should move over to the other trailer while the other 2-person team is completing the installation of their second plate on the trailer. Both trailers are installed using the same procedures.

**Basic Steps for Installation:**

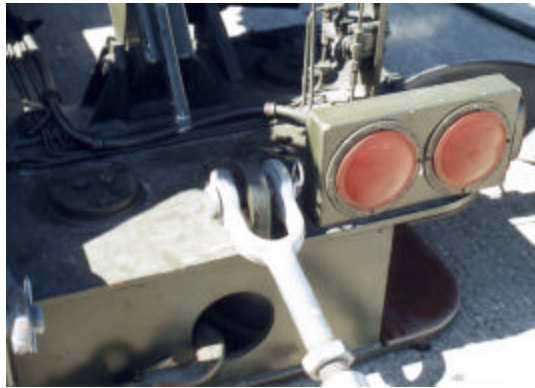
With the trailers positioned and lowered,

Attach the three turnbuckles to the three anchor points (figures 105, 106, and 107) on the MAAS trailer. Note: The left rear anchor point may also be referred to as the pretension anchor point.

**Figure 105. Left Rear Anchor Point with Turnbuckle – Both MAAS Trailers.**



**Figure 106. Right Rear Anchor Point with Turnbuckle – Both MAAS Trailers.**



**Do not actually install the turnbuckle on the right rear wheel anchor point until you determine that there is enough clearance to allow use of the installation tools.** Figure 107 just shows the conflict between the turnbuckle, the anchor point, mud flap, and wheel hub.

**Figure 107. Right Rear Wheel Anchor Point with Turnbuckle – Both MAAS Trailers.**



**NOTE:** When the right rear wheel of the MAAS trailer is removed, a triple-turnbuckle fitting can be installed on the right rear wheel anchor point of the MAAS trailer prior to installing the locknut end of a turnbuckle. This will provide additional clearance (figure 108) from the wheel brake drum during drilling. Even with the additional clearance under the right rear wheel brake drum, installation of the anchor plate may also require removing the rear portion of the cruciform stake storage rack bracket to allow installation of the two anchor bolts farthest away from the turnbuckle.

**Figure 108. Additional Clearance Using Triple-Turnbuckle Fitting.**



Attach the other end of the each turnbuckle to an anchor plate and align the plate directly in line with the anchor points.

**CAUTION:** All six anchor bolts are required and must be installed to provide a safety margin for use. **If the installation of the MAAS is an emergency installation where time is critical** and if there is a problem with installation of the anchor bolts, then a minimum of four properly installed bolts will meet an arrestment load of a 40,000-pound aircraft engaging at 150 knots. When time permits, install the remaining bolts.

**There is no T.O. certified emergency installation for heavier weight fighter aircraft; all six bolts are required.**

Install the anchor plates per normal installation procedures.

When all three plates have been anchored and turnbuckles tightened, then tighten the locknuts on the turnbuckles.

**NOTE:** Ensure that the turnbuckles are tightened in tension and not by being expanded, since expanding the turnbuckles will also give a taut effect.

Repeat the actions for the trailer on the other side of the runway.

#### **Basic Steps for Readyng the MAAS:**

While each MAAS trailer is being installed, unless personnel are required to assist in the installation of the trailers, remove the hook cable from its storage reel and drag it across the runway.

**NOTE:** If hook cables have been prepositioned at the base location and are to be used instead of the 90-foot and 153-foot hook cables supplied with the MAAS, then the prepositioned cable must be brought to the site, prepared for use (to include placing support discs on cable), and dragged across the runway.

Pull out enough slack in the tape system to enable the hook cable to be attached to the tape connectors. This slack may be obtained by pulling the tape out of the trailer using two or three personnel or by connecting the tape to a vehicle. Ensure that the shuttle valve on the BAK-12 is in the OFF position for this operation. If a LWFB is being installed with the MAAS, pull out the tape, reeve the beams, and install the tape connectors.

Attach the ends of the hook cable to the tape connectors.

Evenly space the support discs on 8- to 10-foot centers along the length of the barrier hook cable. Avoid placing a support disc at the centerline of the runway operating surface.

Confirm that all anchor plates are installed, tightened, and inspected on both trailers. Start the BAK-12 rewind engine, per normal operating procedures.

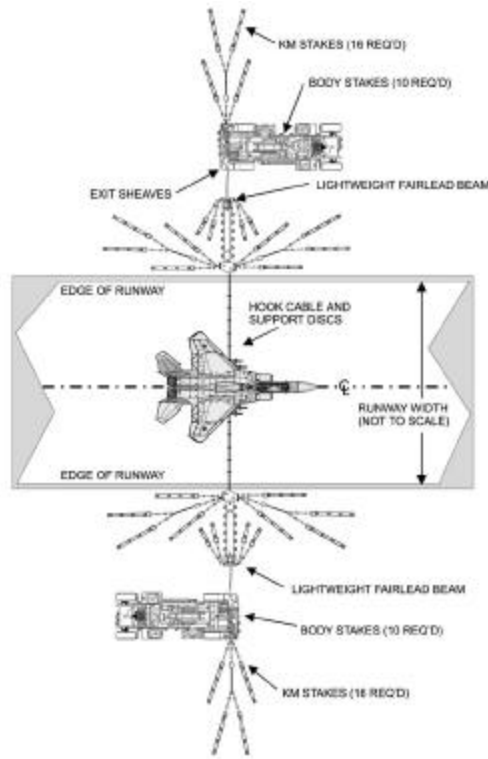
Pretension the hook cable, per normal operating procedures.

Shut down the BAK-12 rewind engine.

**MAAS on Soil for Use with a Fairlead Beam:**

Installation of the MAAS on a soil surface (figure 109) with a CBR of more than 7 is accomplished by installing body stakes and a double in-line KM Anchoring System. The anchor mechanism uses body stakes at ten MAAS stake pockets and two sets of KM stake lines using a double 4-stake system (figure 110), for a total of 26 stakes.

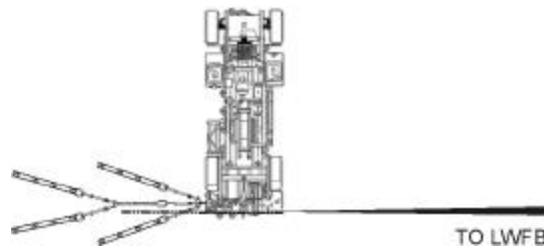
**Figure 109. MAAS on Soil Base (with a LWFB shown).**





The KM stake lines are installed in-line with the MAAS's barrier tape and off the left rear anchor location on each MAAS. The locations are not dependent on the approach direction of the aircraft. Body stakes are required for this installation off the runway operating surface. This installation method can support heavier weight fighter aircraft operations.

**Figure 110. Detailed Layout of 26-Stake System.**



Installing both the MAAS and a Fairlead beam **requires separate operations with a split distance that exceeds 50 feet.** This requires that at least one of the HPUs must be removed from the trailer and that more personnel are available to rapidly install the MAAS with a Fairlead beam. A 6-person installation team, made up of two 2- or 3-person teams, can begin installation of the MAAS. Each smaller team is assigned to a hydraulic power unit (HPU) on one side of the trailer and proceeds to use hydraulic breakers to drive stakes into the soil. Once the body stakes are installed, then the HPU on the right side may be removed and used for the installation of the Fairlead beam. The installation steps below are for the basic procedures and the installation team chief may adjust personnel between the two groups installing the MAAS and the Fairlead beam. Both trailers are installed using the same procedures. Installation items are to be found on the MAAS trailer.

**Basic Steps for Installation:**

With the trailers positioned and lowered, remove the required installation tools, hardware, and the work stands stored on each trailer.

Remove the rear stake storage bracket and the ninemoil point bushings; store the bushings in the equipment module storage box.

Connect the 50-foot hydraulic hose to the right side HPU and the quick disconnect block. Ensure that the quick disconnect fittings are clean before connecting.

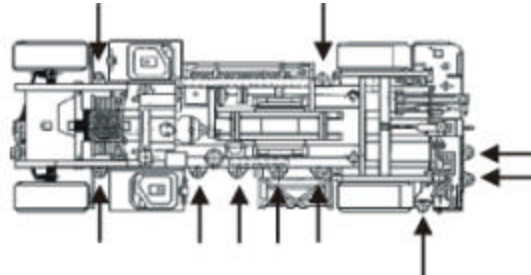
**GENERAL NOTE:** When a MAAS trailer has received the ETL 98-10 upgrade, it will have the Stanley stake driver, which is an integral unit and does not require the use of a drive shank and stake driver. Throughout the following instructions for installation of stakes in the KM stakes lines and/or in body stake holders, when mention is made of using a hydraulic breaker with a drive shank and stake driver, an integral Stanley stake driver may be used in lieu of the a hydraulic breaker.

Start the right side HPU, per normal operating procedures. Lower the rear wheels to the ground to facilitate installation of the body stakes.

Install the 1 1/4-inch hex drive shank and the 3 1/2-inch stake driver on each hydraulic breaker unit.

Connect the hydraulic breakers to the 50-foot hoses attached to the HPUs. Ensure that the quick disconnect fittings are clean before connecting. Start the other HPU, per normal operating procedures.

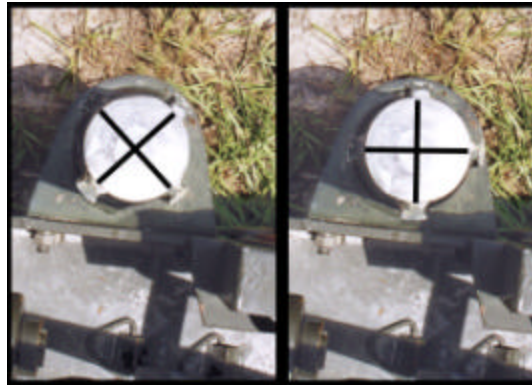
Using the hydraulic breakers and works stands (if required), install the ten stakes in the stake pockets located along the outside of the trailer (figure 111).

**Figure 111. Stake Body Locations on the MAAS.**

**General Instruction:** The stakes are painted green on the top 18 inches of stake. The stakes are driven into the soil until the painted portion of the stake reaches ground level (figure 112) and ensure that the stakes are oriented to allow stake removal. The stake pullers require different stake orientation, as shown for the current hydraulic ram stake puller (PHOTO ON THE LEFT) and the Stanley stake puller (PHOTO ON THE RIGHT) (figure 113).

**Figure 112. Typical Body Stake Installation.**

**Figure 113. Proper Stake Orientation with the Body.**



After installation of the body stakes, reconnect the 50-foot hydraulic hose to the right side HPU and raise the rear axle support frame, per normal operating procedures. Reconnect the hydraulic breaker to the 50-foot hoses attached to the HPU. Ensure that the quick disconnect fittings are clean before connecting.

Attach the triple-turnbuckle fitting to the left rear anchor point, also referred to as the pretension anchor point, adapter fitting (see Attachment 2).

**NOTE:** A trailer adapter fitting must first be installed on the left rear anchor point before a triple-turnbuckle fitting can be installed for this installation method.

Attach the turnbuckles to the triple-turnbuckle fitting (figure 114).

**Figure 114. Turnbuckles on Triple-Turnbuckle Fitting.**



**Installation Using the Chain Sling with the LWFB or Standard Fairlead Beam:**

Install the chain sling (PN 52D10726-3) to the middle turnbuckle with the 1 1/4-inch clevis pin and hitch clip pin. Pull the chain taut away from the MAAS, parallel to the direction of the where the tape will leave the MAAS sheave (figure 115).

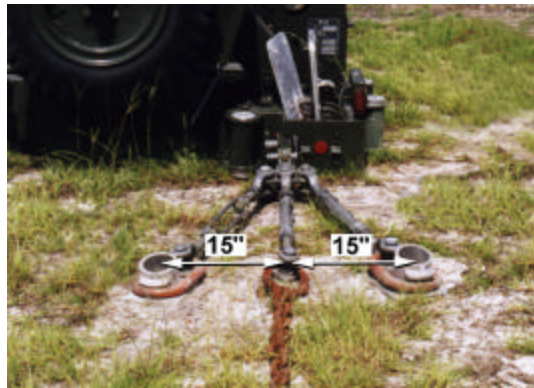
**Figure 115. Align Chain Sling.**

Hold the chain taut and locate the two stake lines such that the center of both of the first stake guides are approximately 15 inches from the chain line and on each side of the chain line (figure 116).

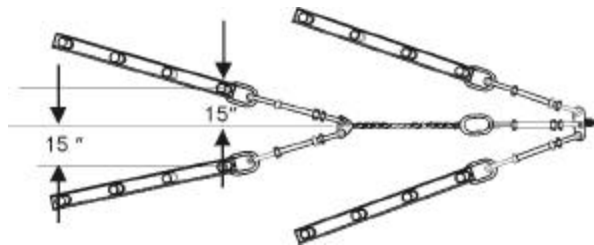
Install a four stake KM stake line per normal installation procedures on both side of the chain sling.

Tighten both the turnbuckles equally to remove any slack in the outrigger, but do not over-tighten it to cause the trailer to move.

Install a triple-turnbuckle fitting to the free end of the chain. Attach two turnbuckles to the outer holes of the fitting.

**Figure 116. Locating the Front Stake Lines.**

The two remaining sets of KM outriggers on the triple-turnbuckle fitting at the end of the chain sling are located such that the first stake holders are approximately 15 inches away from and on both sides of a line that would extend from the chain line (figure 117).

**Figure 117. Locating the Rear Stake Lines.**

Install the two remaining sets of KM outrigger stake lines per normal installation procedures.

Tighten both the turnbuckles equally to remove any slack in the outrigger, but do not over-tighten it to cause the trailer to move.

**Final Check:**

Perform a final tightening check on all the turnbuckles and tighten the locknuts on each turnbuckle.

Repeat the actions for the trailer on the other side of the runway.

**Basic Steps for Readyng the MAAS:**

During the process of installing a Fairlead beam, **an operational check is made for tape tracking using a vehicle to pull the tape.** Therefore, the MAAS tape has to be extended, reeved through the Fairlead beam, and the tape end connectors installed. Then the following steps are required.

The barrier crew personnel remove the hook cable from its storage reel and drag it across the runway.

**NOTE:** If hook cables have been prepositioned at the base location and are to be used instead of the 90-foot and 153-foot hook cables supplied with the MAAS, then the prepositioned cable must be brought to the site, prepared for use (to include placing support discs on cable), and dragged across the runway.

Pull out enough slack in the tape system to enable the hook cable to be attached to the tape connectors. This slack may be obtained by pulling the tape out of the trailer using two or three personnel or by connecting the tape to a vehicle. Ensure that the shuttle valve on the BAK-12 is in the OFF position for this operation.

Attach the ends of the hook cable to the tape connectors.



Evenly space the support discs on 8- to 10-foot centers along the length of the barrier hook cable. Avoid placing a support disc at the centerline of the runway operating surface.

Confirm that all turnbuckles on both MAAS trailers and Fairlead beam anchoring systems have been installed and tightened and the lock nuts have been tightened. Start the BAK-12 rewind engine, per normal operating procedures.

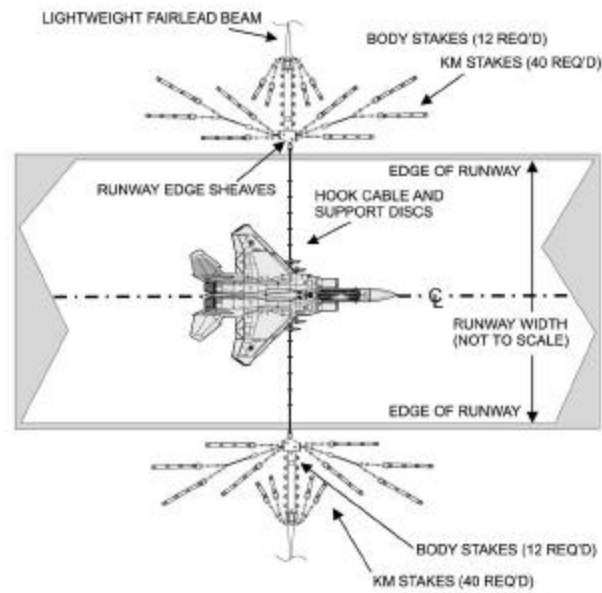
Pretension the hook cable, per normal operating procedures.

Shut down the BAK-12 rewind engine.

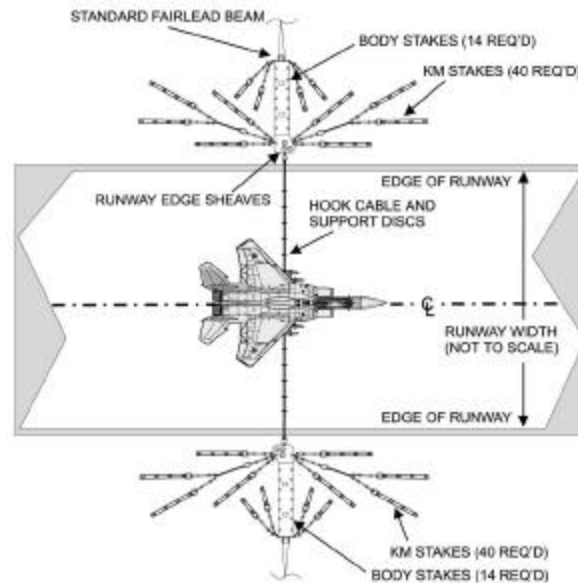
**Lightweight Fairlead Beam (LWFB) and Standard Fairlead Beam on Soil:**

Installation of the LWFB (figure 118) and the Fairlead beam (figure 119) on a soil surface with a CBR of at least 15 can be accomplished by installing body stakes and four sets of double in-line KM Anchoring systems. This installation method can support heavier weight fighter aircraft operations and is bi-directional.

**Figure 118. LWFB on Soil – Bi-directional Operation.**



**Figure 119. Standard Fairlead Beam on Soil with KM Stake Lines – Bi-directional Operation.**



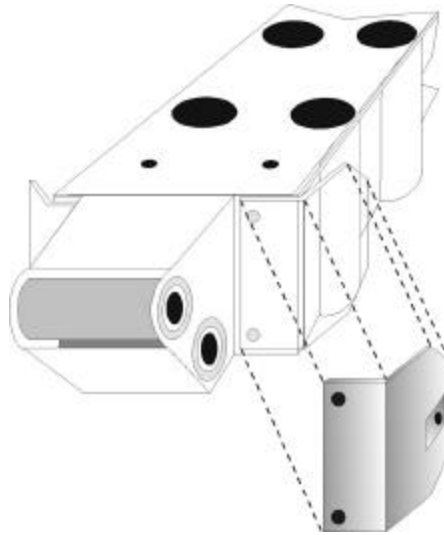
The anchor mechanism uses:

- two sets of in-line KM stake lines with a double 4-stake system at the front of the beam,
- two sets of in-line KM stake lines with a double 2-stake system at the rear of the beam, and
- either 12 body stakes in the LWFB stake pockets or 14 body stakes in the Fairlead beam stake pockets.

The total number of stakes used is 52 stakes for the LWFB or 54 stakes for the Fairlead beam.

To use this system with the Standard Fairlead beam, the beam must be fitted with two adapter brackets (P/N 52-D-104438-1) located on both sides at the rear (lead-on) sheave for the beam (figure 120).

**Figure 120. Standard Fairlead Beam Adapter Brackets (Right Side Detail)**



**GENERAL NOTE:** When a MAAS trailer has received the ETL 98-10 upgrade, it will have the Stanley stake driver, which is an integral unit and does not require the use of a drive shank and stake driver. Throughout the following instructions for installation of stakes in the KM stakes lines and/or in body stake holders, when mention is made of using a hydraulic breaker with a drive shank and stake driver, an integral Stanley stake driver may be used in lieu of the a hydraulic breaker.

Installing both the LWFB and the Fairlead beam with the MAAS requires separate operations with a split distance that exceeds 50 feet. Therefore, this requires that the MAAS right side hydraulic power unit (HPU) must be removed from the MAAS trailer and moved to the LWFB and the Fairlead beam location. As anchoring of the MAAS can be accomplished faster than the LWFB or the Fairlead beam, the second MAAS HPU may also be removed when the MAAS is installed and moved over to assist with the LWFB or the Fairlead beam anchoring.

A 6-person team, made up of two 3-person teams, can begin installation of the LWFB or the Fairlead beam. A rapid installation of both the LWFBs or the Fairlead beams and MAAS trailers will require more than 6 personnel. Each 3-person team is assigned to one side of the LWFB or the Fairlead beam to lay out the anchor lines and use the HPU with hydraulic breakers to drive stakes into the soil. After the KM Anchoring systems are installed, the tapes are run from the MAAS trailers, reeved through the LWFBs or the Fairlead beams, and the tape is then pulled out 300 feet in both directions. **The tape is checked for tracking through the LWFB or the standard Fairlead beam sheaves.** The turnbuckles are used for any adjustments required to correct tracking. The turnbuckles are tightened and the locknuts tightened. The body stakes are driven into the LWFB or the standard Fairlead beam. The tape connectors are then attached to the hook cable.

The installation steps below are the basic procedures for installation of each LWFB or the standard Fairlead beam; the installation team chief may adjust personnel between the personnel installing the LWFB or the standard Fairlead beam and the MAAS. LWFBs and standard Fairlead beams are installed using the same KM anchor stake installation procedures used for the MAAS. Installation items are to be found on the LWFB trailer or must be brought separately for the standard Fairlead beam. HPUs, hydraulic breakers, and stake drivers are found on the MAAS trailers.

**Basic Steps for Installation:**

The LWFB or the standard Fairlead beam is attached to a sling, which is capable of carrying a load of 1,000 pounds, and moved into position with a front-end loader. When the LWFB or the standard Fairlead beam is positioned, remove the required installation tools and hardware from the extra kit items ordered for the standard Fairlead beam and/or the LWFB and MAAS trailers.

**NOTE: No matter which siting method is used and how precise the MAAS and LWFB or standard Fairlead beam have been sited and placed into position, the MAAS with LWFB or standard Fairlead beam must have an Operational Check performed to ensure that the tape is properly aligned and tracking through the beam. Do not get ahead of yourselves when installing the system and think that the placement of the beams or MAAS is complete until the Operational Check for tracking has been performed.**

Ensure that all 14 turnbuckles are adjusted equally to approximately 36 inches between the centers of the two clevis pins.

Attach triple-turnbuckle fitting to all four LWFB or the standard Fairlead beam anchor points using the 1 1/4-inch clevis pins and hitch clip pins.

**Anchoring the front of the LWFB or Standard Fairlead Beam:****Installation of the first stake line:**

Attach the three turnbuckles to the triple-turnbuckle fitting at the front left side of the LWFB or the standard Fairlead beam.

Install the chain sling to the middle turnbuckle of the triple-turnbuckle fitting on the LWFB or the standard Fairlead beam. Start installation with the turnbuckle closest to the runway.

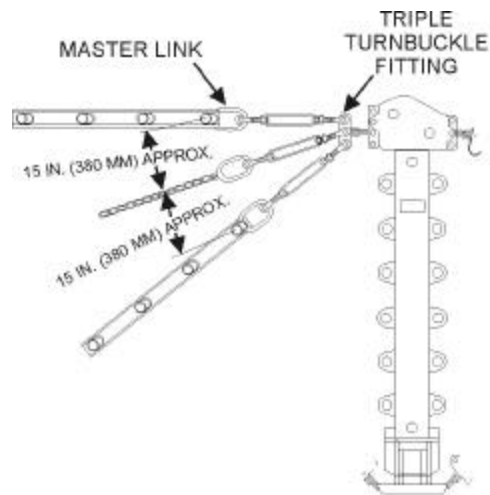
The first stake line is installed parallel to the edge of the runway operating surface.

Install the 4-stake line per normal installation procedures.

**Installing the second KM stake line:**

Pull the chain taut so that it is 15 inches from the center of the first stake guide. Locate next stake line (figure 121) such that the center of its stake guide is 15 inches from the centerline of the chain.

**Figure 121. Locating the Second Stake Line.**



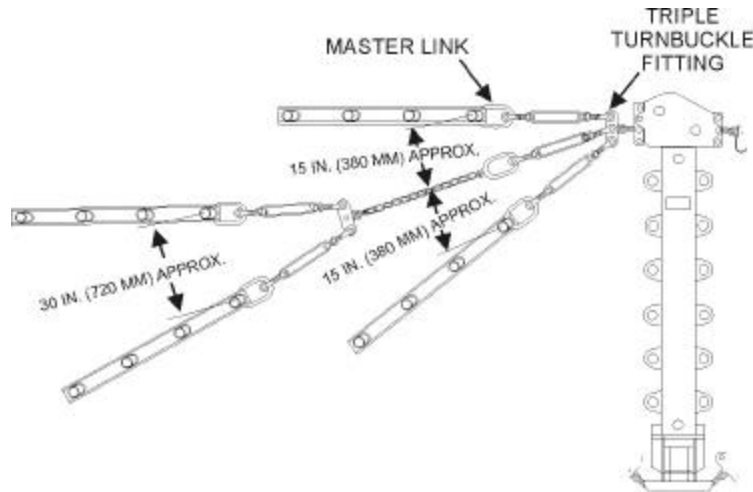
Install the 4-stake line per normal installation procedures.

**Installing the two sets of KM stake lines on the chain:**

Install a triple-turnbuckle fitting to the end of the chain line and install two turnbuckles, one on each outside hole.

Attach the free ends of two master links to the turnbuckles and install the master links around two stake guides. Pull the two stake guides taut and locate them so that the centers of the stake guides are 30 inches apart and located equally on each side of the chain's extended centerline (figure 122).

**Figure 122. Locating the Front Rear Stake Lines.**



Install the two 4-stake lines per normal installation procedures.

Repeat all of the above steps for the outriggers and KM stake lines for the right front side of the LWFB or the standard Fairlead beam.



When all front anchor lines have been installed, tighten all the front turnbuckles to remove any slack in the outriggers, but do not over-tighten them, which would cause the beam to move.

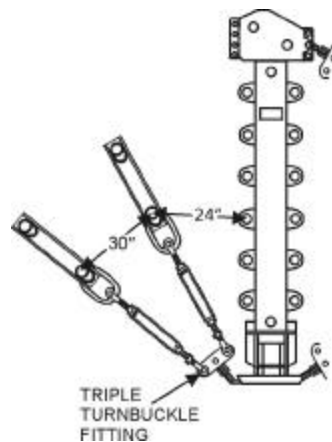
**Anchoring the back of the LWFB or Standard Fairlead Beam:**

Attach the two turnbuckles to the triple-turnbuckle fitting at the back left side of the LWFB or the standard Fairlead beam.

Attach the free ends of two master links to the two turnbuckles and install the master links around two stake guides.

Pull the stake guide closest to the beam taut and measure approximately 24 inches between the center of the stake guide and the center of the third body stake hole for a LWFB (figure 123). NOTE: Use the fourth body stake hole when measuring from the standard Fairlead beam.

**Figure 123. Locating the Rear Stake Lines.**



Install the 2-stake line per normal installation procedures.

Pull the remaining stake guide and master link taut on the turnbuckle and locate its center 30 inches from the center of the first stake guide that was just installed.

Install the second 2-stake line per normal installation procedures.

Repeat the above steps six for the two KM stake lines for the right back side of the LWFB or the standard Fairlead beam.

Tighten all the rear turnbuckles to remove any slack in the outriggers, but do not over-tighten them to cause the beam to move.

**Operational Check and Body Stake Installation:** Before proceeding with anchoring of the LWFB or the standard Fairlead beam body stakes, the tape must be run from the MAAS, reeved through the beam, and have the tape connectors attached. The tape must be pulled out (figure 124) 300 feet in both directions down the runway. Follow the specific TO procedures.

**Figure 124. Tape Pull Out Prior to Body Stake Installation.**



While doing this, **check the tape entering the lead on sheaves of the LWFB or the standard Fairlead beam for tracking alignment.**

Adjust the turnbuckles for any tracking alignment corrections. If tracking alignment can not be corrected by adjusting the turnbuckles, then the MAAS or the LWFB or standard Fairlead beams may have to be repositioned to correct the alignment.

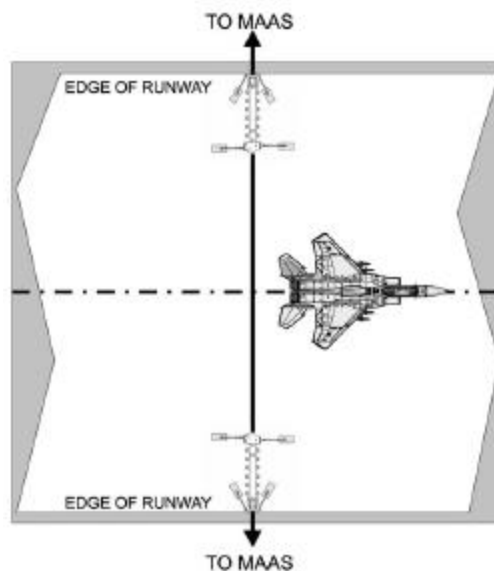
Perform a final tightening of all turnbuckles and tighten all lock nuts. Do not over-tighten the turnbuckles and cause the beam to move.

Using the hydraulic breakers and work stands (if required), install the 12 stakes through the LWFB body stake pockets or the 14 stakes through the standard Fairlead beam body stake pockets.

**Lightweight Fairlead Beam (LWFB) on Concrete:**

Installation of the LWFB on a concrete runway (figure 125) is possible using four additional concrete anchor plate assemblies and two additional bolts for each LWFB. This installation method can support heavier weight fighter aircraft operations and is bi-directional.

**Figure 125. LWFB on Concrete – Bi-directional Operation.**

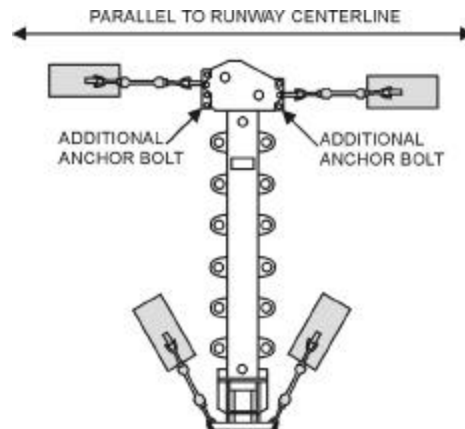


The anchor mechanism uses a concrete anchor plate with 1-inch diameter anchor bolts with a tapered nut. Two additional Concrete Installation Hardware kit assemblies (Table 3) based on Installation Kit 52-D-7800-107 are required for each LWFB and two additional anchor bolts at the head of each LWFB (figure 126).

**Table 3. LWFB Installation Kit Components (for one LWFB).**

Concrete Installation Kit Components (from MAAS trailer) Required for Each Lightweight Fairlead Beam			
Item	Qty	Part Number	Description/Stock Number
1	4	52-C-8265-101	Anchor Plate 1710-01-315-5978
2	24	52-B-10765-1	Taper Bolt 5310-01-254-2370
3	24	133933-012	Washer, Flat 5310-01-258-7792
4	8	52-D-7800-20	Hitch Pin Clip 5340-01-246-5874
5	4	HG-228- 1½x 12	Turnbuckle 5340-01-283-4056
6	40	3460-2	Nut 6515-01-234-0952

**Figure 126. Typical LWFB Anchoring Requirements on Concrete.**



Installing the LWFB with the MAAS requires separate operations with a split distance that exceeds 50 feet. This requires that the MAAS right side hydraulic power unit (HPU) must be removed from the MAAS trailer and moved to the LWFB location. If anchoring of the MAAS is accomplished faster than for the LWFB, the second MAAS HPU may also be removed when the MAAS is installed and moved over to assist with the LWFB anchoring. All other tools and equipment for this installation are stored on each MAAS unit.

At least a 4-person team, made up of two 2-person teams, can begin installation of the LWFB. A rapid installation of the LWFBs and MAAS trailers will require more than 6 personnel. Each 2-person team is assigned to one side of the LWFB to install the anchor plates and use the HPU with hydraulic hammer drills for drilling six holes per each plate. Once the anchor plates are installed, the barrier tapes are run from the MAAS trailers, reeved through the LWFBs, and the tape is then pulled out 300 feet in both directions. **The tape is checked for tracking through the LWFB sheaves.** The turnbuckles are used for any adjustments required to correct tracking. The tape connectors are then attached to the barrier hook cable.

The installation steps below are the basic procedures for installation of each LWFB; the installation team chief may adjust personnel between the personnel installing the LWFB and the MAAS. The LWFBs are installed using the same concrete anchor plate installation procedures used for the MAAS.

#### **Basic Steps for Installation:**

The LWFB is attached to its sling and moved into position with a front end loader. When the LWFB is positioned, remove the required installation equipment, tools, and hardware from the additional concrete anchoring kits and the LWFB and MAAS trailers.

**NOTE:** No matter which siting method is used and how precise the MAAS and LWFB have been sited and placed into position, the MAAS with LWFB must have an Operational Check performed to ensure that the tape is properly aligned and tracking through the beam. Do not get ahead of yourselves when installing the system and think that the placement of the beam or MAAS is complete until the Operational Check for tracking has been performed.

Install the drill bit in the hydraulic hammer drill.

Connect the hydraulic hammer drills to the 50-foot hoses attached to the HPUs. Ensure that the quick disconnect fittings are clean before connecting.

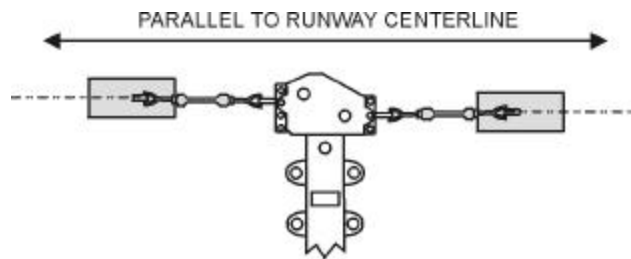
Ensure that all turnbuckles have been adjusted to approximately 36 inches between the centers of the two clevis pins.

Attach the four turnbuckles to the front and back beam anchor brackets.

Attach the other end of the turnbuckles to the anchor plates.

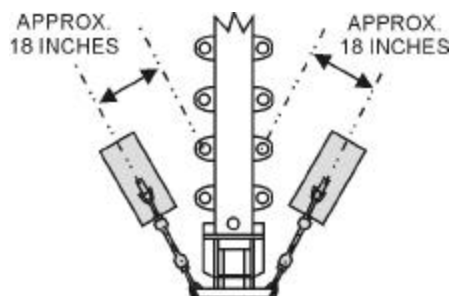
Align the front anchor plates (figure 127) such that the plate turnbuckle connection is parallel to a line drawn across the front of the beam and parallel to the edge of the runway operating surface.

**Figure 127. Align Front Anchor Plates on Concrete.**



Align the back anchor plates (figure 128) such that the turnbuckle fittings on the concrete anchor plates are located equally on each side of the rear sheave support assembly and approximately 18 inches from the center of the second LWFB body stake holder.

**Figure 128. Align Back Anchor Plates on Concrete.**



Install the plates per normal installation procedures.

**CAUTION:** All six anchor bolts are required and must be installed to provide a safety margin for use.

Adjust the taper nut such that inserting requires tapping with a 4-pound hammer. Seat all taper bolts and nuts using the hammer and taper bolt gauge to obtain the required 3/8-inch clearance between the bolts head and the anchor plate.

Tighten down all bolts.

When all anchor plates have been installed, tighten the turnbuckles to remove any looseness in the system, but do not over-tighten them, which would cause the LWFB to move. Ensure that the turnbuckles are tightened in tension and not by being expanded, since expanding the turnbuckles will also give a taut effect.



**Operational Check:**

Before proceeding any further, the tape must be run from the MAAS, reeved through the beam, and have the tape connectors attached. The tape must be pulled out 300 feet in both directions down the runway.

While doing this, the tape entering the lead on sheaves of the LWFB is checked for tracking alignment.

**Adjust the turnbuckles as required to correct tracking alignment.**

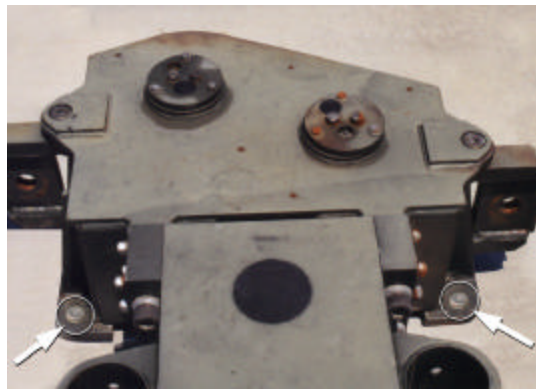
Tighten all lock nuts on the turnbuckles.

**Front Bolt Holes:**

Using the rear bolt holes at the front end on both sides of the LWFB sheave front end assembly as guides, drill two additional bolt holes.

Install two anchor bolts (figure 129).

**Figure 129. Install Two Concrete Anchor Bolts at Front of LWFB.**



Adjust the taper nuts such that inserting requires tapping with a 4-pound hammer. Seat the two taper bolts and nuts using the hammer and taper bolt gauge to obtain the required 3/8-inch clearance between the bolts head and the bottom flange of the MAAS front-end assembly. Tighten the bolts.

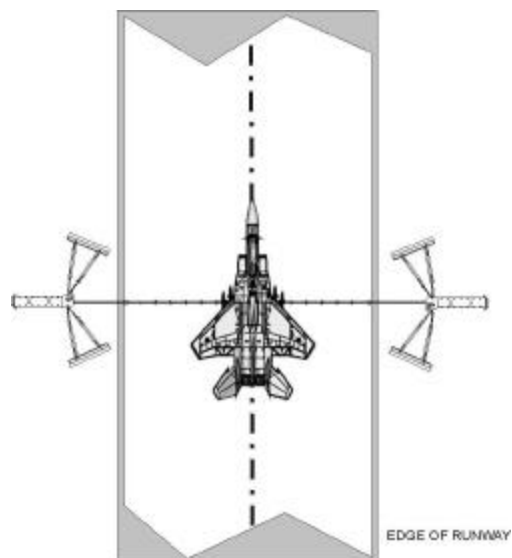
Shut down the HPU and store all the installation tools and equipment upon completion.

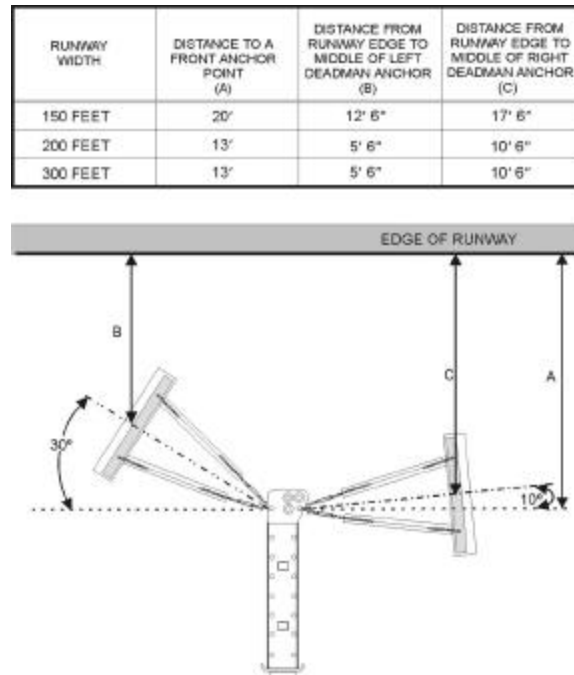
Repeat the actions for the trailer on the other side of the runway.

**Standard Fairlead Beam on Soil Using Deadman Anchors:**

Installation of the standard Fairlead beam on a soil surface (figure 130) may also be accomplished by installing body stakes and deadman anchors (figure 131). There are 14 stakes located in the body stake holders and two deadman anchors located at the front anchoring locations of each standard Fairlead beam. This installation method can support heavier weight fighter aircraft operations and is bi-directional.

**Figure 130. Standard Fairlead Beam Setup Using Deadman Anchors.**



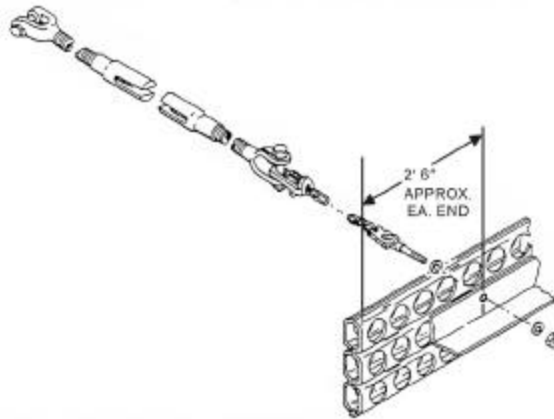
**Figure 131. Typical Standard Fairlead Beam Layout.**

The standard Fairlead beam locations are not dependent on the approach direction of the aircraft. More than the regular six-person team will be required for digging, filling, and compacting trenches associated with the installation of the deadman anchors. This installation requires support of heavy equipment and operators. Both trailers are installed using the same procedures

Obtaining and fabricating metal deadman and backer plates (figure 132) will be required ahead of the installation. The materials should be obtained and/or fabricated prior to deployment when rapid installation is required. The requirement consists of:

- 4 each of P/N 152-A-1396-1 Chain Assembly Anchors,
- 2 each of the triple-turnbuckle fittings,
- 4 each of the triple turnbuckles,
- 2 each 6 inch x 6 inch x 3/8 inch by 12 foot steel angle backing plates (or suitable structural plate), and either
- 4-12 foot PSP or 2-12 foot AM2 matting sheets.

**Figure 132. Typical Fabrication of Chain and Deadman.**



The installation steps outlined below do not detail the construction of the deadman anchors. See T.O. 35E8-2-5-1 for instruction on fabricating the dead-man anchor assemblies.

**Basic Steps for Installation:**

The standard Fairlead beam is attached to its sling and moved into position with a front end loader. Position the standard Fairlead beam for the required runway setback and barrier hook cable location. Mark on the ground the locations where the two anchor points will fall at the front left and right side of the Fairlead beam.

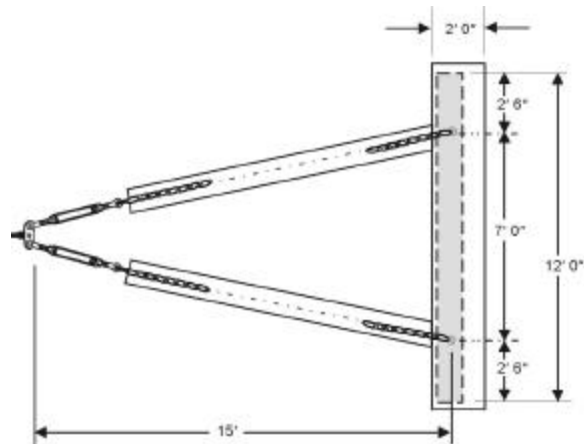
A backhoe, roller-compactor, compactor plates, shovels, and/or excavator could be used for the installation of the deadman anchors.

Verify the length of the deadman anchor chains as laid out to ensure that the exact dimension are known. Anchor chains, triple-turnbuckle fitting, turnbuckles, and plate attachment hardware should measure out to approximately 15 feet.

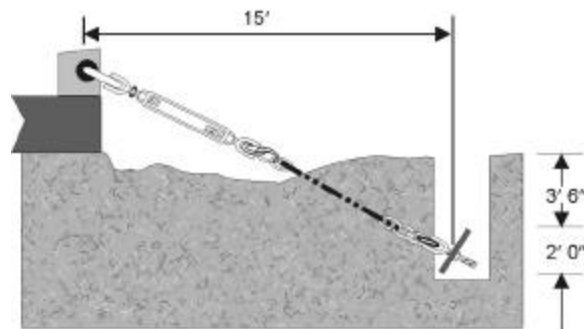
**NOTE:** The locknut end of the turnbuckles is to be toward the Fairlead beam.

Based on the anchor point locations and the measured dimensions, lay out the locations for the trenches (figures 133 and 134).

**Figure 133. Typical Deadman, Chain, and Trench Layout – Plan View.**



**Figure 134. Typical Deadman, Chain, and Trench Layout – Elevation View**



Dig the trenches, starting with the chain anchor trenches to avoid caving in the larger deadman trench. Ensure that the deadman trench has a vertical front face and has at least 3 feet 6 inches of cover is above the top of the deadman.

**Installing the Deadman Anchors:**

Adjust the four turnbuckles that will be used for the connection so that there is approximately 39 inches between the centers of the two clevis pins.

Attach the turnbuckles to the triple-turnbuckle fittings and attach the triple-turnbuckle fittings to the Fairlead beam front anchor points.

Connect each of the deadman anchors to the anchor chain assembly and lower the deadman anchors into the trenches.

Fill the deadman trench first to a depth of 6 inches over the deadman. Compact the soil.

Pretension the anchors enough to stretch the chains out, but do not allow the standard Fairlead beam to move. Ensure that the chain does not rotate and possibly loosen the nuts on the anchor plate.

Continue to fill the trench using 6-inch lifts and compact each lift.

Repeat filling in and compacting the anchor chain trenches up to the turnbuckles.

Compact and level the trenches.

Fully tension all the turnbuckles and tighten the lock nuts. Do not over-tighten the turnbuckles and cause the beam to move.



**Operational Check and Body Stake Installation:**

Before proceeding with anchoring of the standard Fairlead beam body stakes, the tape must be run from the MAAS, reeved through the beam, and have the tape connectors attached. The tape must be pulled out 300 feet in both directions down the runway.

While doing this, **the tape entering the lead on sheaves of the standard Fairlead beam are checked for tracking alignment.**

Shift the rear of the standard Fairlead beam to adjust for any tracking alignment corrections.

**Adjust the turnbuckles as required to correspond with and correct tracking alignment.**

Tighten all lock nuts on the turnbuckles.

**GENERAL NOTE:** When a MAAS trailer has received the ETL 98-10 upgrade, it will have the Stanley stake driver, which is an integral unit and does not require the use of a drive shank and stake driver. Throughout the following instructions for installation of stakes in body stake holders, when mention is made of using a hydraulic breaker with a drive shank and stake driver, an integral Stanley stake driver may be used in lieu of the a hydraulic breaker.

Connect the 50-foot hydraulic hoses to the MAAS's HPUs and connect the hoses to the hydraulic breakers. Ensure that the quick disconnect fittings are clean before connecting.

Install the 1 1/4-inch hex drive shank and the 3 1/2-inch stake driver on each hydraulic breaker unit. Start the HPUs, per normal operating procedures.

**General Instruction:** The stakes are painted green on the top 18 inches of stake. The stakes are driven into the soil until the painted portion of the stake reaches ground level. **The stake must be driven in to at least a 36-inch depth to be acceptable.**

Install the 14 stakes through the standard Fairlead beam body stake pockets using the hydraulic breaker with drive shank.

Store all the installation tools upon completion.

Repeat the actions for the trailer on the other side of the runway.

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DCS/Installations & Logistics



## **ATTACHMENT 1 ETL 98-10 UPGRADE EQUIPMENT**

The following five items comprise the recent ETL 98-10 upgrade package for the MAAS.

### **A1. Stanley Hydraulic Power Unit**



**A2. Stanley Hydraulic Breaker**



**A3. Stanley Stake Driver**



**A4. Stanley Rotary Drill**



**A5. Stanley Stake Puller**



## **ATTACHMENT 2**

### **MAAS TRAILER INSTALLATION HARDWARE – ADAPTER FITTING**

The trailer adapter fitting (figure B1), which includes one (1) each of parts 52D10259-1, G4065—1 1/2, and 52D7800-20, is provided as a part of the Lightweight Fairlead Beam Configuration for use when installing the MAAS. However, the fitting is also required for installations of the MAAS on soil when using deadman anchors or KM stake lines with chain (figure B2). The fitting is installed at the left rear (pretension) anchor point and is to be used with a triple turnbuckle fitting (figure B3).

#### **B1. Trailer Adapter Fitting**



**B2. Trailer Adapter Fitting Installed with Triple-Turnbuckle Fitting and Turnbuckles**



**B3. Trailer Adapter Fitting with Triple-Turnbuckle Fitting**

